

Introduction

The National Institute of Standards and Technology (NIST) facilitated the development of this Footwear and Tire Examination Process Map through a collaboration between the NIST Forensic Science Research Program and the NIST administered Organization of Scientific Area Committees (OSAC) for Forensic Sciences (specifically OSAC’s Footwear and Tire Subcommittee).

This Footwear and Tire Examination Process Map (Current Practice) captures details about the various procedures, methods and decision points most frequently encountered in the discipline of footwear and tire examination from a national perspective and **is intended to reflect current practices**. The discipline requires examiners to make many decisions that can impact the quality and accuracy of results. The Footwear and Tire Examination Process Map can benefit the discipline by providing a behind-the-scenes perspective into the various components and decision points in the examination process.

Process mapping is the visual representation of the critical steps and decision points of a process. Components of the process are deconstructed, placed into specific shapes within a flowchart and connected by one-way arrows to indicate directionality regarding decisions as well as progression throughout the overall process. The shape of each box assists the reader by representing a specific type of activity.

This process map captures the **diverse** practices of multiple laboratories, with the goal of allowing a footwear and tire examiner to find their process represented in the map. To ensure this, the mapping team avoided creating a map of what **should** be done (i.e. best practices) and instead attempted to represent all reasonable variations of casework **currently performed** by footwear and tire examiners. For this reason, it is important to state that the OSAC Footwear and Tire Subcommittee does not necessarily support or endorse (as best practices) all of the different steps and paths depicted in this process map.

This map is not intended to be a step-by-step instruction manual outlining minutia, nor is it intended to be so broad that it lacks utility. Rather, judgements were made by the process mapping group as to which steps should be combined and which steps should be divided further. Certain processes represented in the map have a required sequence while other components may vary by examiner or agency. Processes and decisions may also be dictated by agency policy or law.

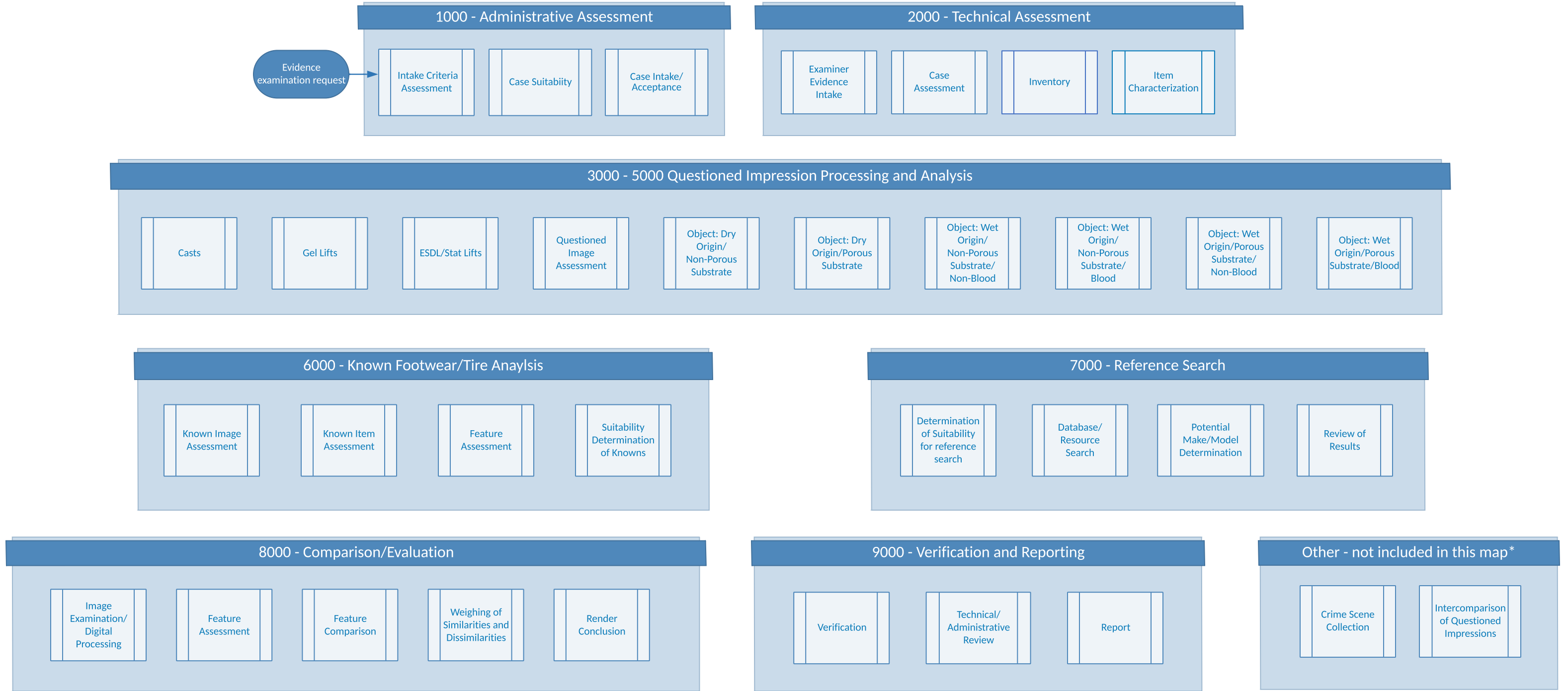
Process Map Applications:

The Footwear and Tire Examination Process Map is intended to be used to help improve efficiencies while reducing errors, highlight gaps where further research or standardization would be beneficial, and assist with training new examiners. It may also be used to develop specific laboratory policies and identify best practices.

Scope of the Footwear and Tire Examination Process Map:

The scope of Footwear and Tire Examination Process Map is limited to core processes within the discipline of footwear and tire examination such as the examination of questioned footwear and tire impressions and the comparison of these impressions to known footwear or tires. Several topics are omitted from this map including crime scene collection and intercomparison of questioned impressions. These topics may subsequently be addressed by the process mapping team, an individual laboratory or a standardization committee.





Underlined Word
Word that will be defined in the glossary

Technology Assist
Technology that aids in the steps on this page

Input Box
Outlines the inputs at the beginning of each section

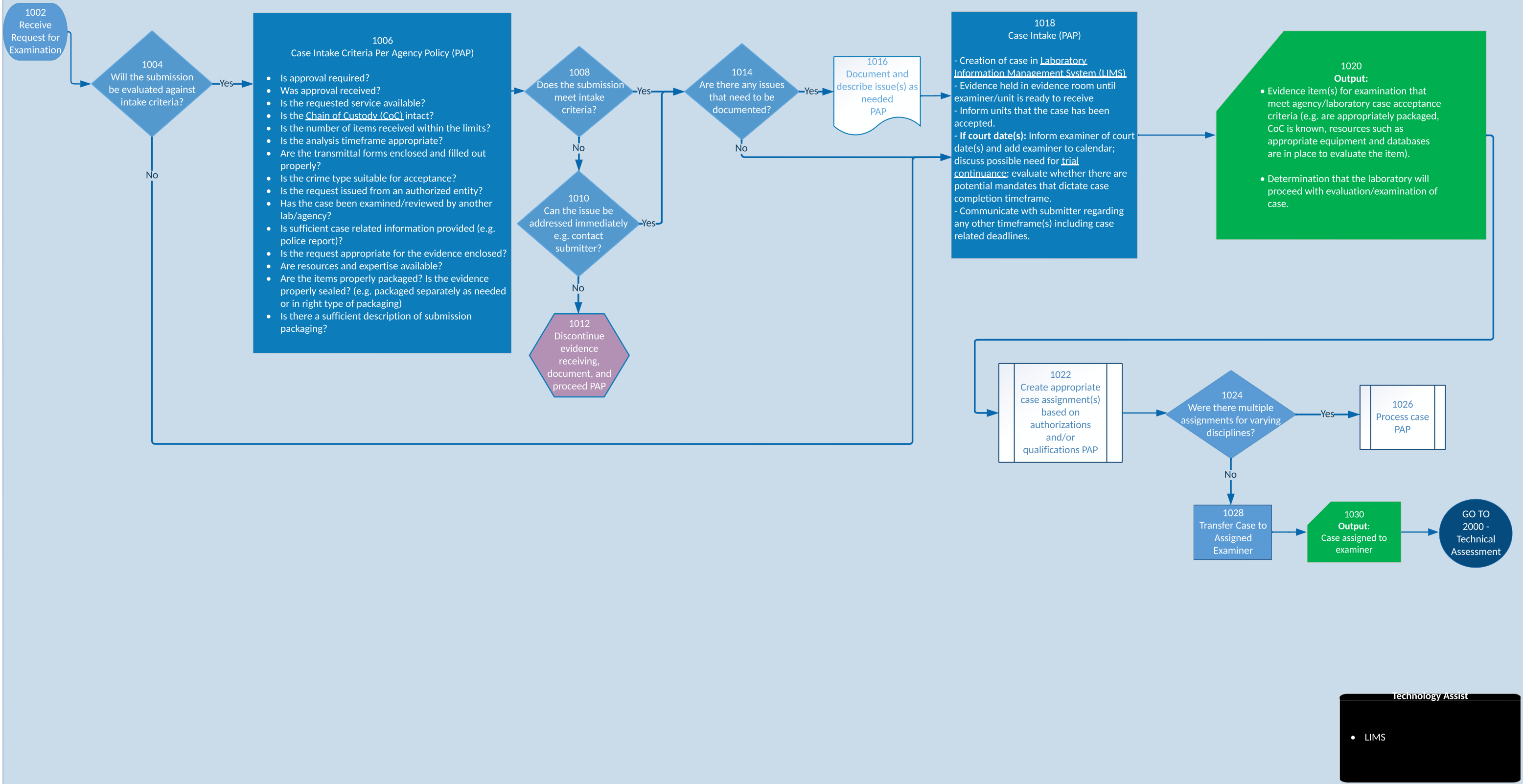
Output Box
Describes an output of the steps on the page

Discontinuation of Assessment or Examination

Legend	
	Process start/end
	Process
	Decision
	Subprocess
	Document

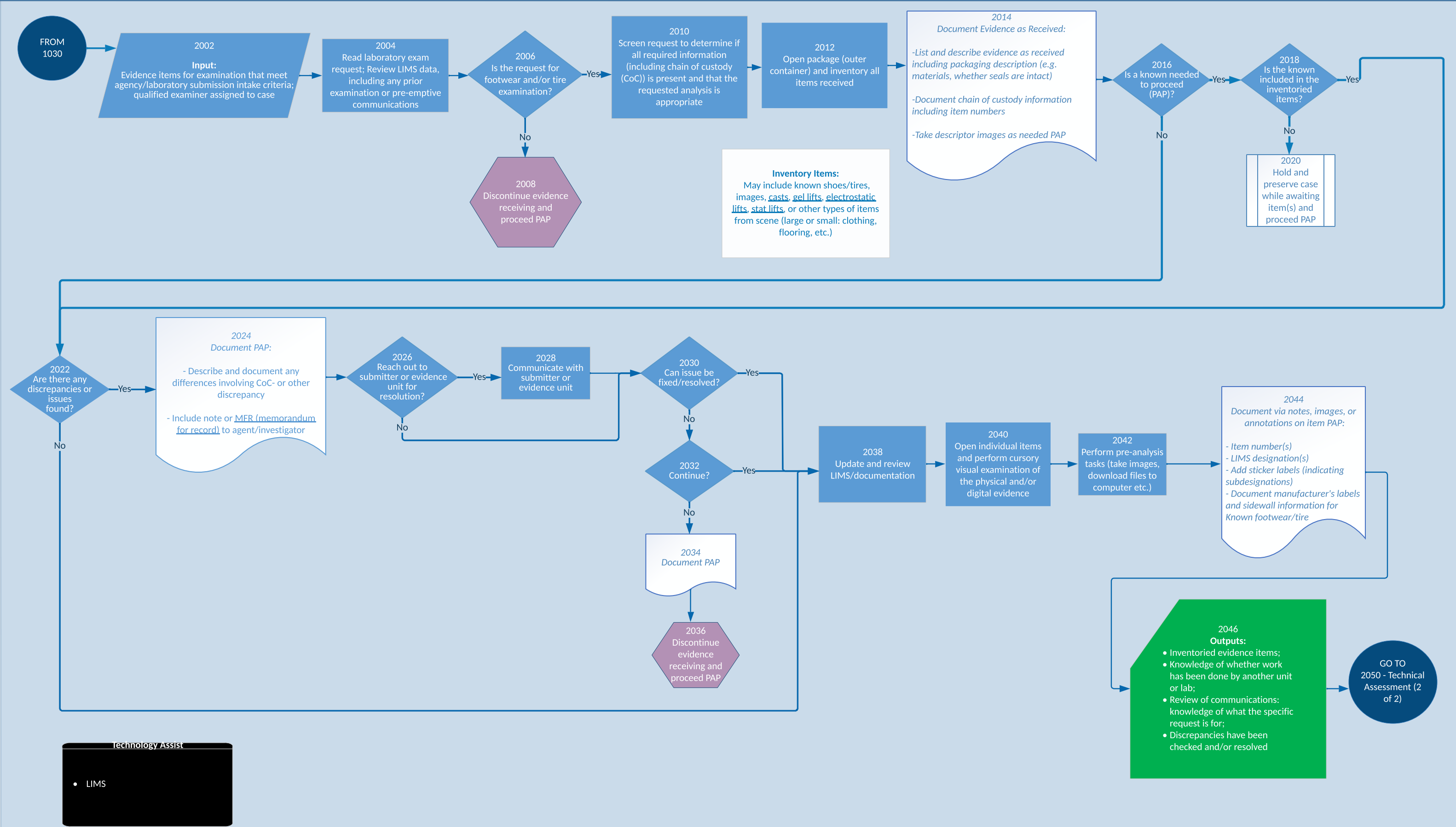
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1000 - Administrative Assessment



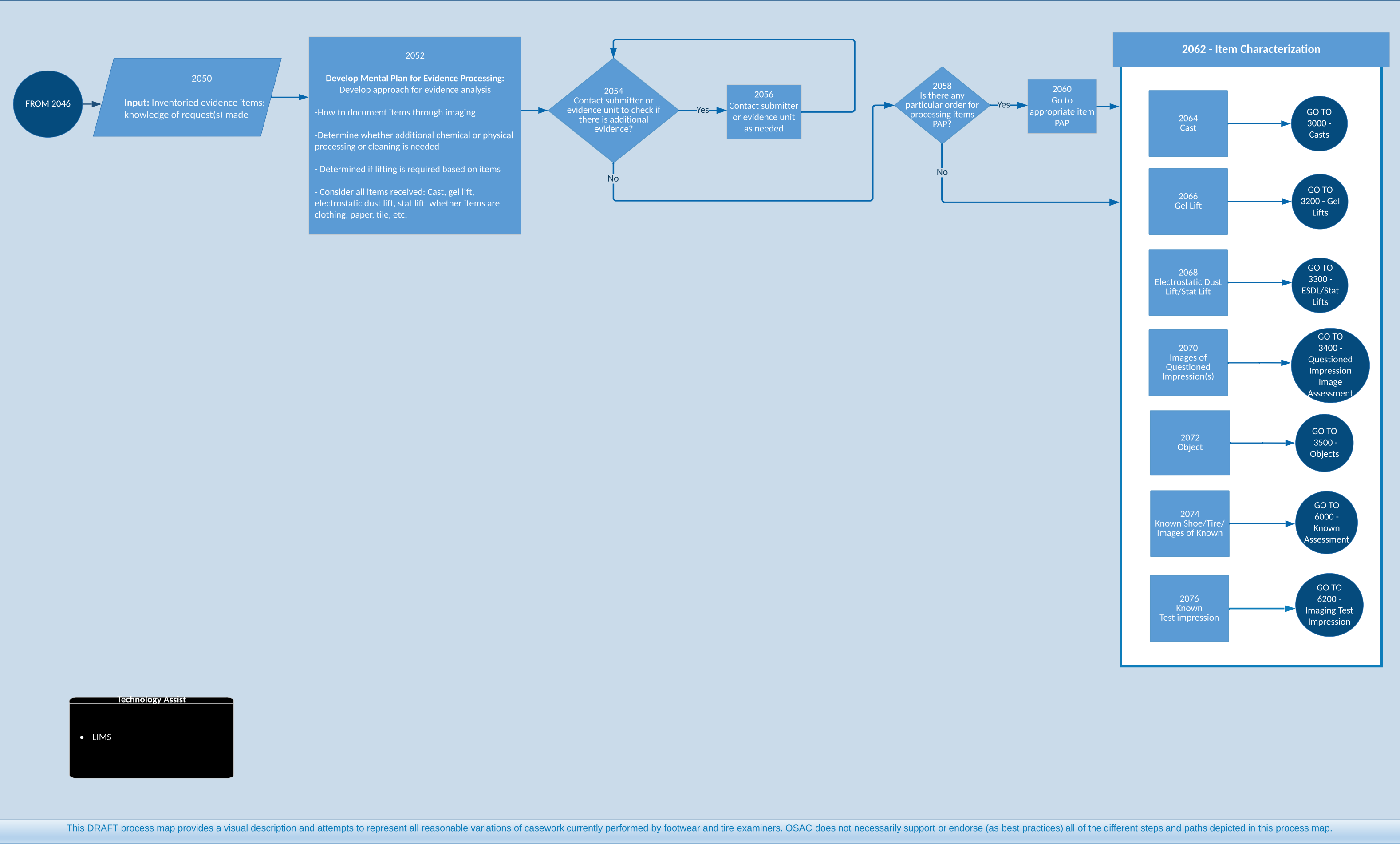
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2000 - Technical Assesment (1 of 2)



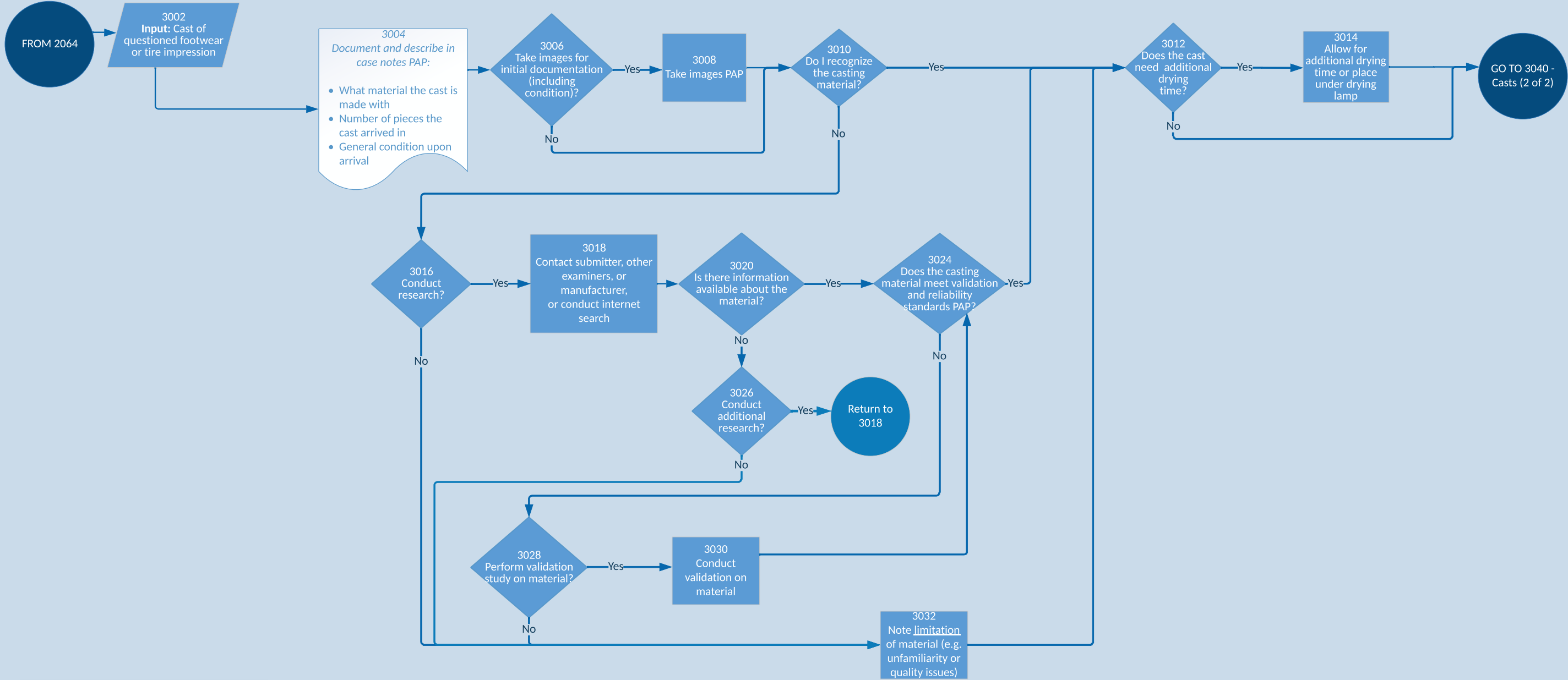
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2000 - Technical Assessment (2 of 2)



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3000 - Casts (1 of 3)



Casting Considerations:
Descriptive Information

- Size**
-Is the size appropriate?
- Orientation Marks**
-Description in COC
-Orientation marks on cast
- Scene Documentation Marks**
-Can cast and photos of same impression be related to one another?
-Impression number on cast from scene documentation?
-Is cast related through documentation to other items of evidence that have been submitted?
-Are the corresponding casts, lifts, photos, impressions labeled as such?

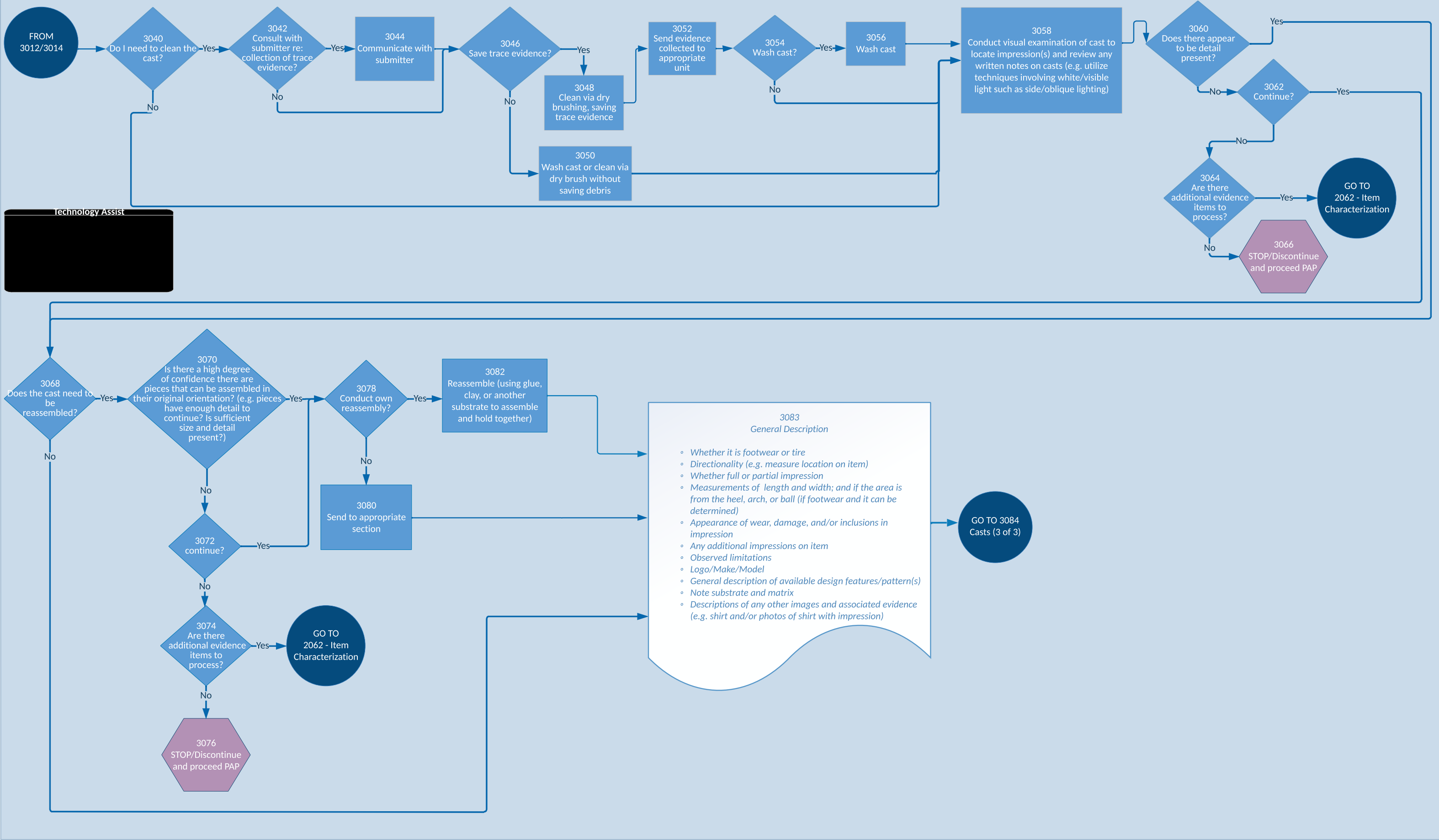
Casting Considerations:
Quality and Materials (potential limitations)

- Quality**
Quality of pour:
-Folds in cast present?
-Features in cast that appear to be interferences from the technique or substrate present?
-Technique and texture
• How it was poured?
• Was a spray coating used?
• Is debris stuck in casting material?
- Materials**
-Has the material been validated? (i.e. Has the material been tested to ascertain whether the casting material reliably captures size and features accurately with no shrinking after drying etc.)
-Density: Too thick/thin?

Technology Assist

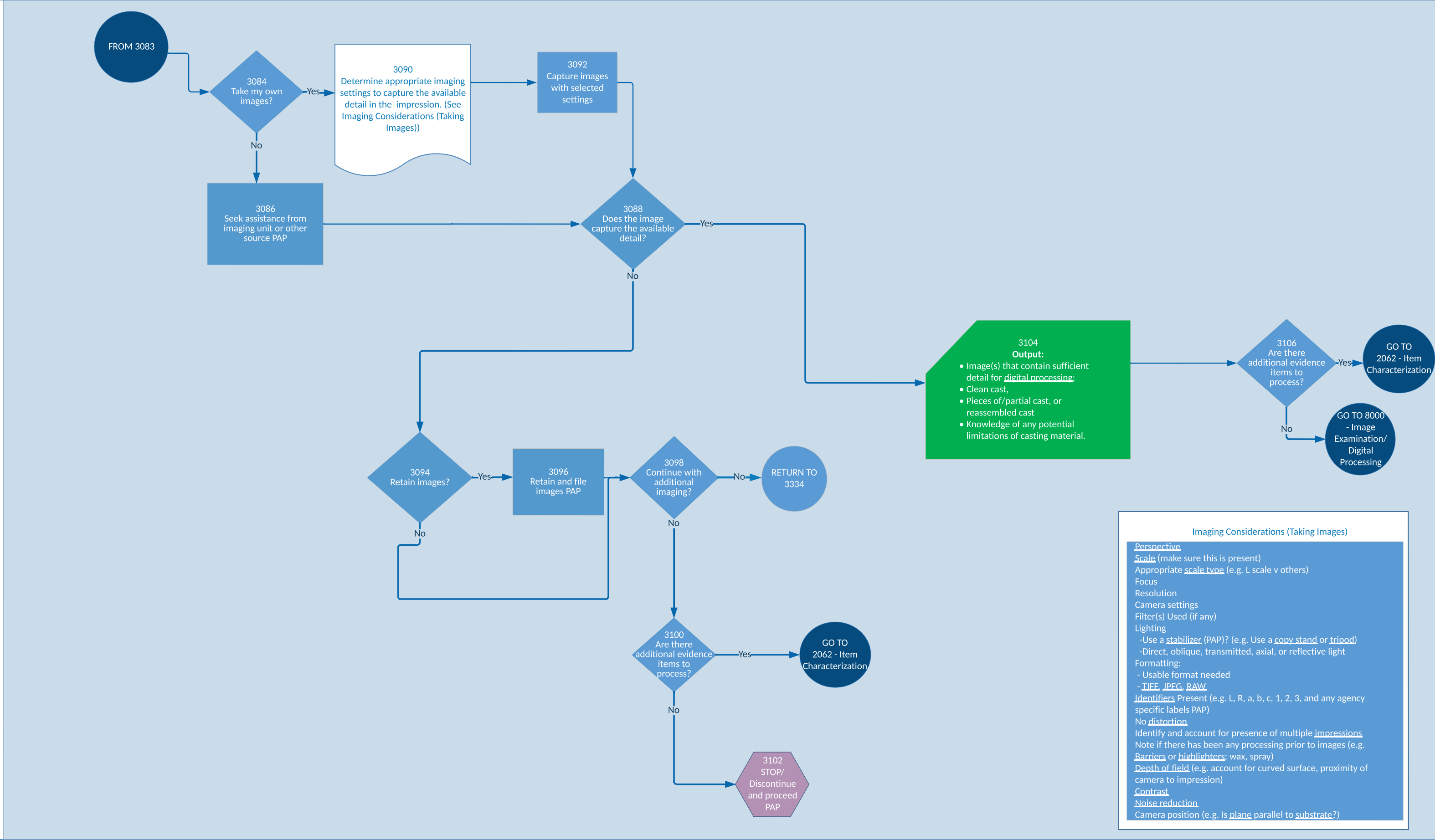
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3000 - Casts (2 of 3)



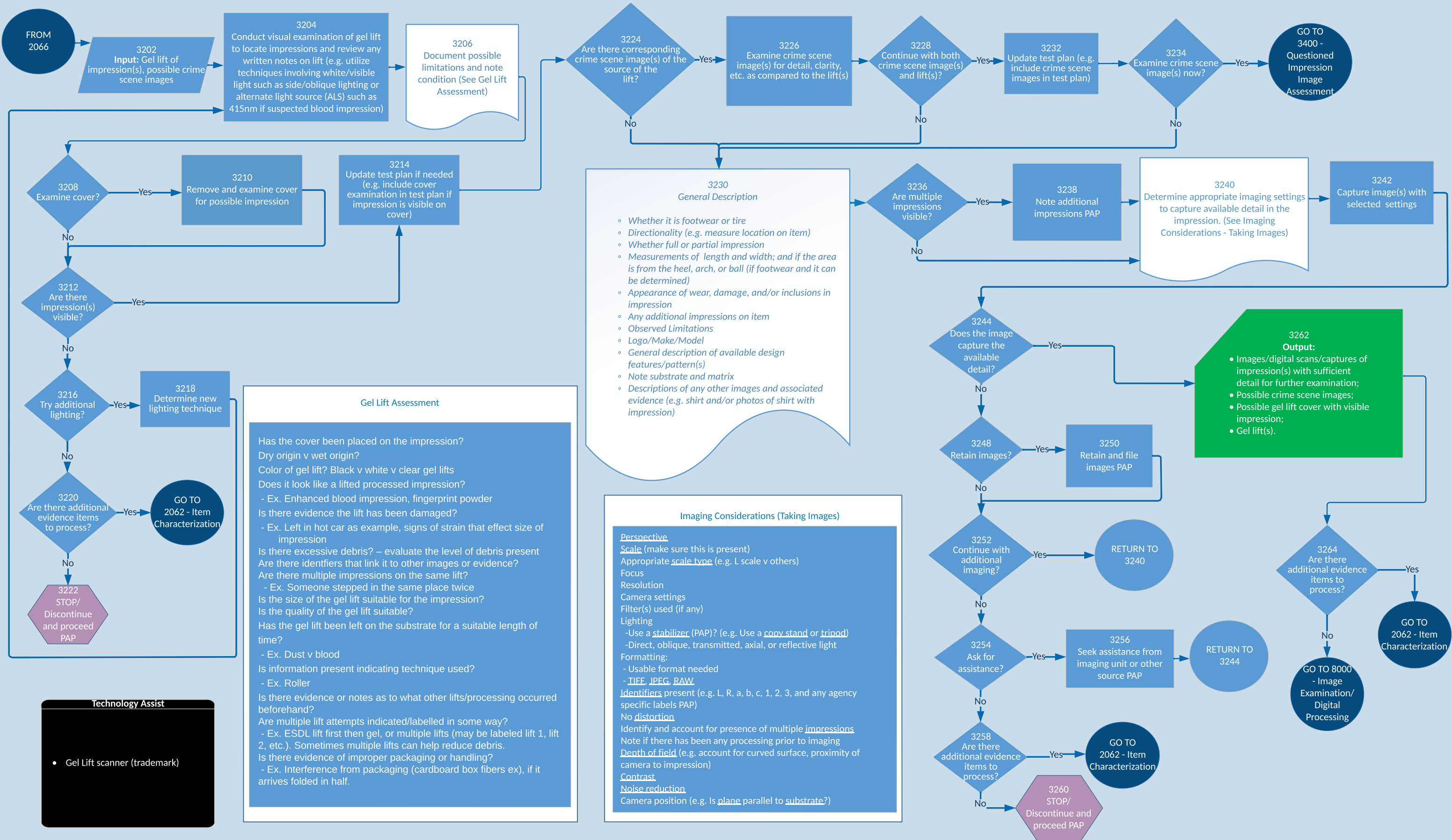
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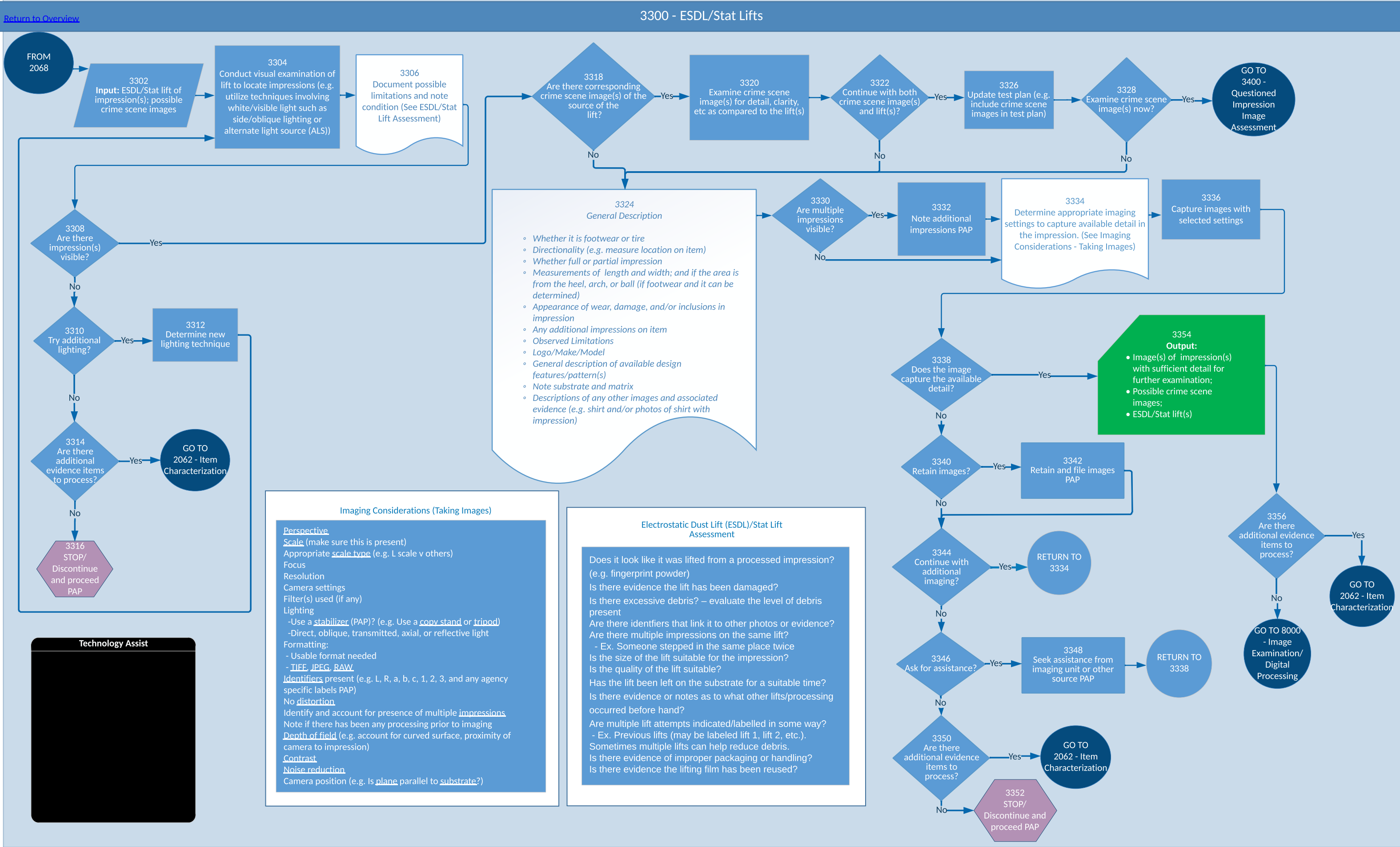
3000 - Casts (3 of 3)



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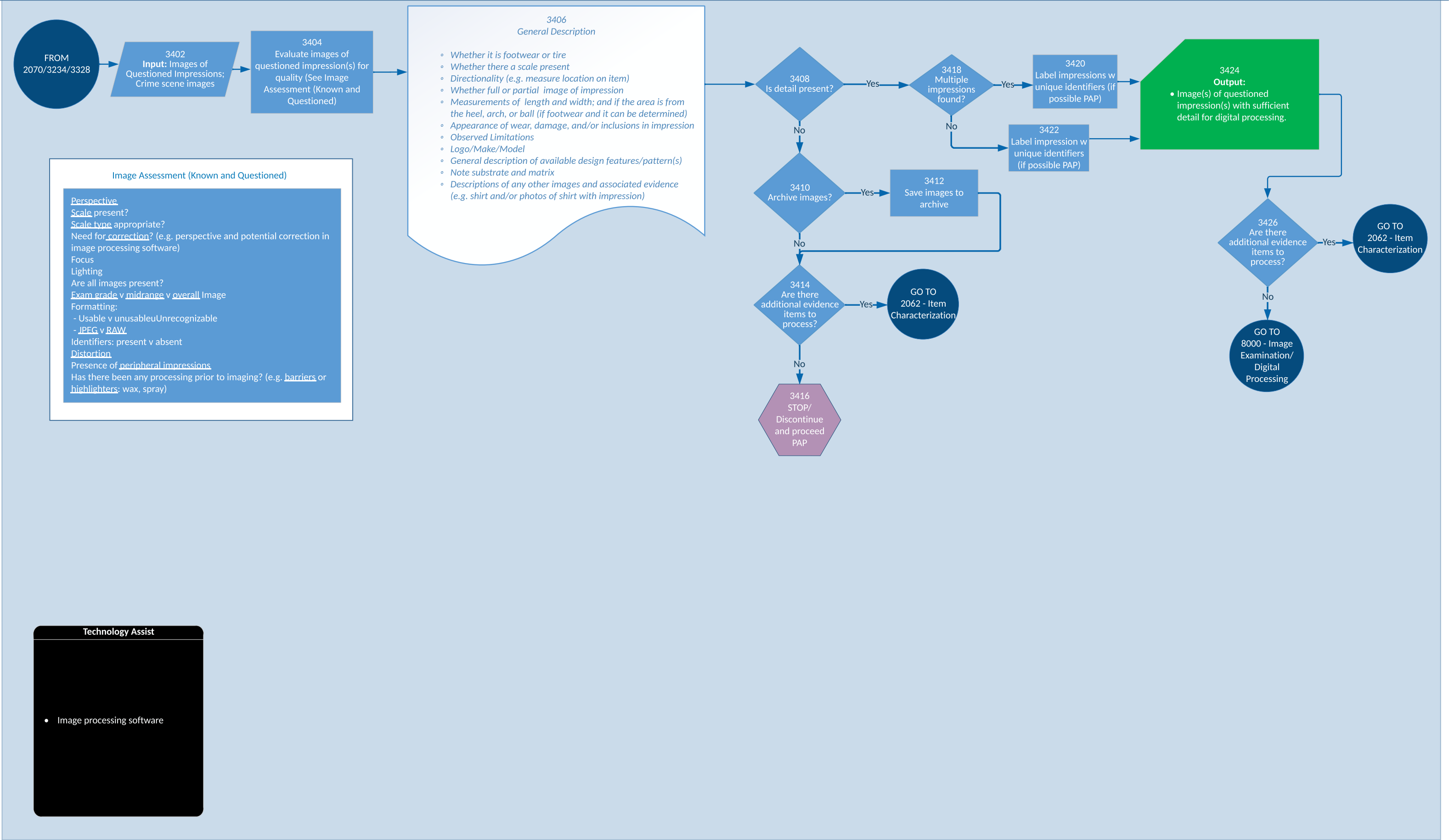
3200 - Gel Lifts





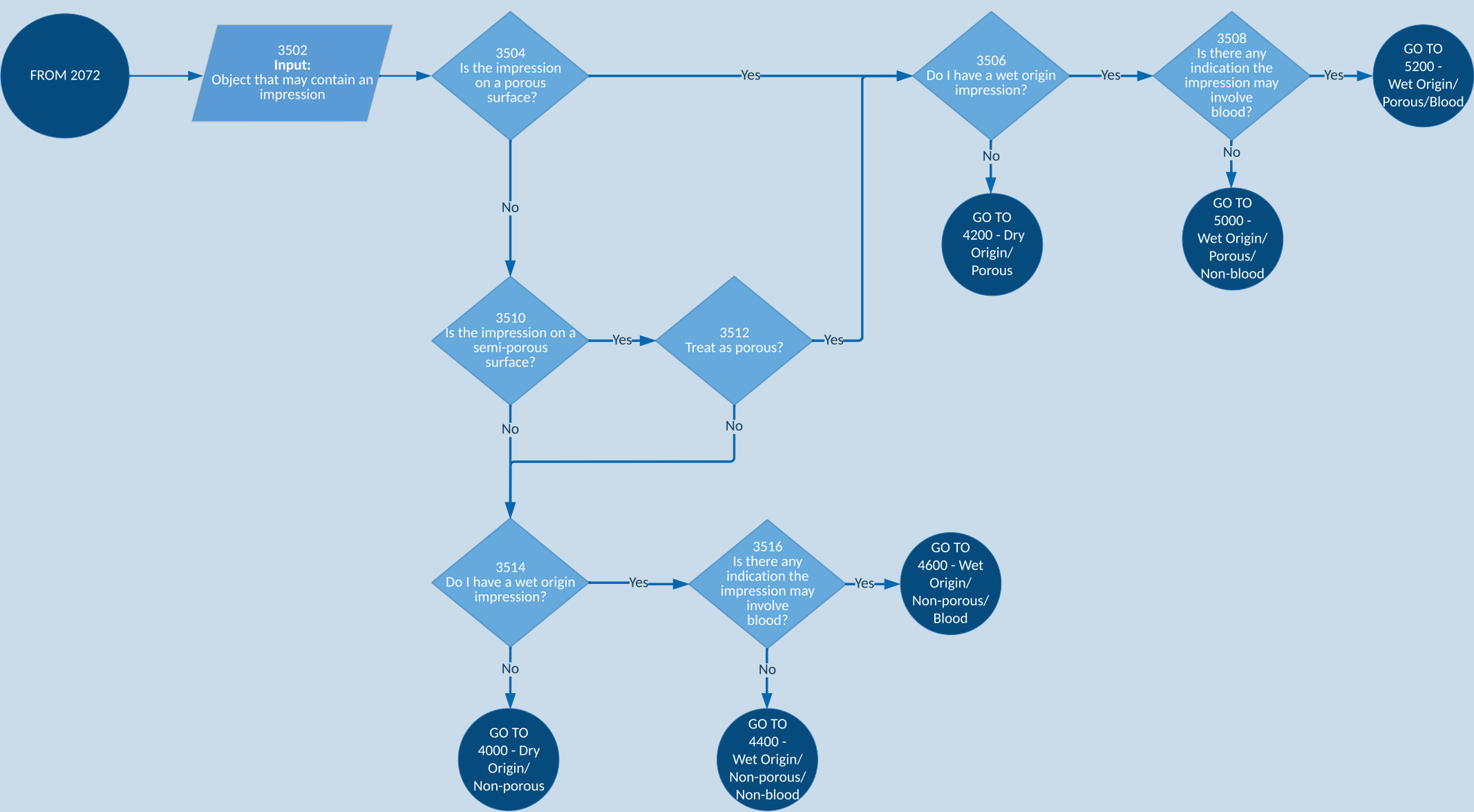
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3400 - Questioned Impression Image Assessment



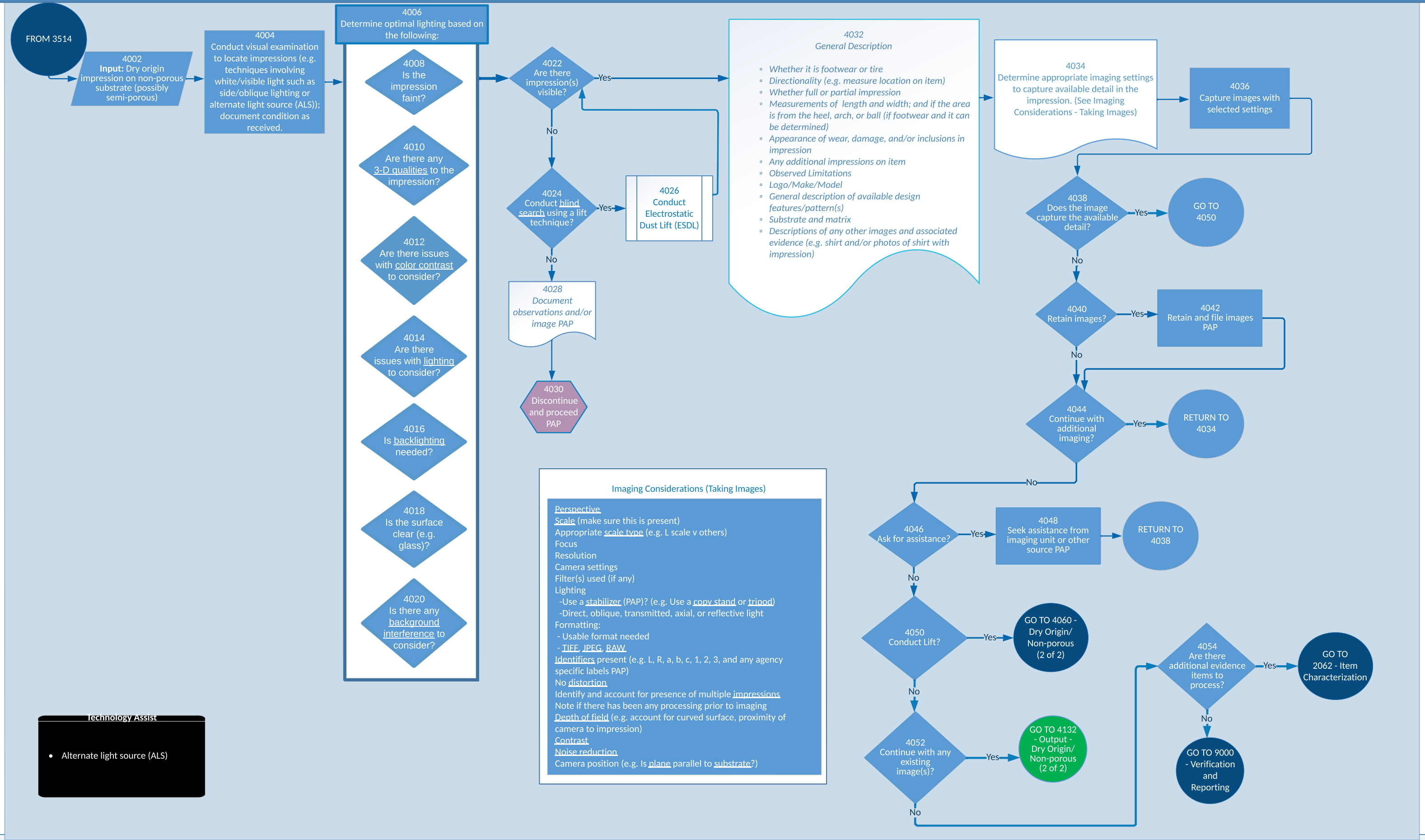
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3500 - Objects

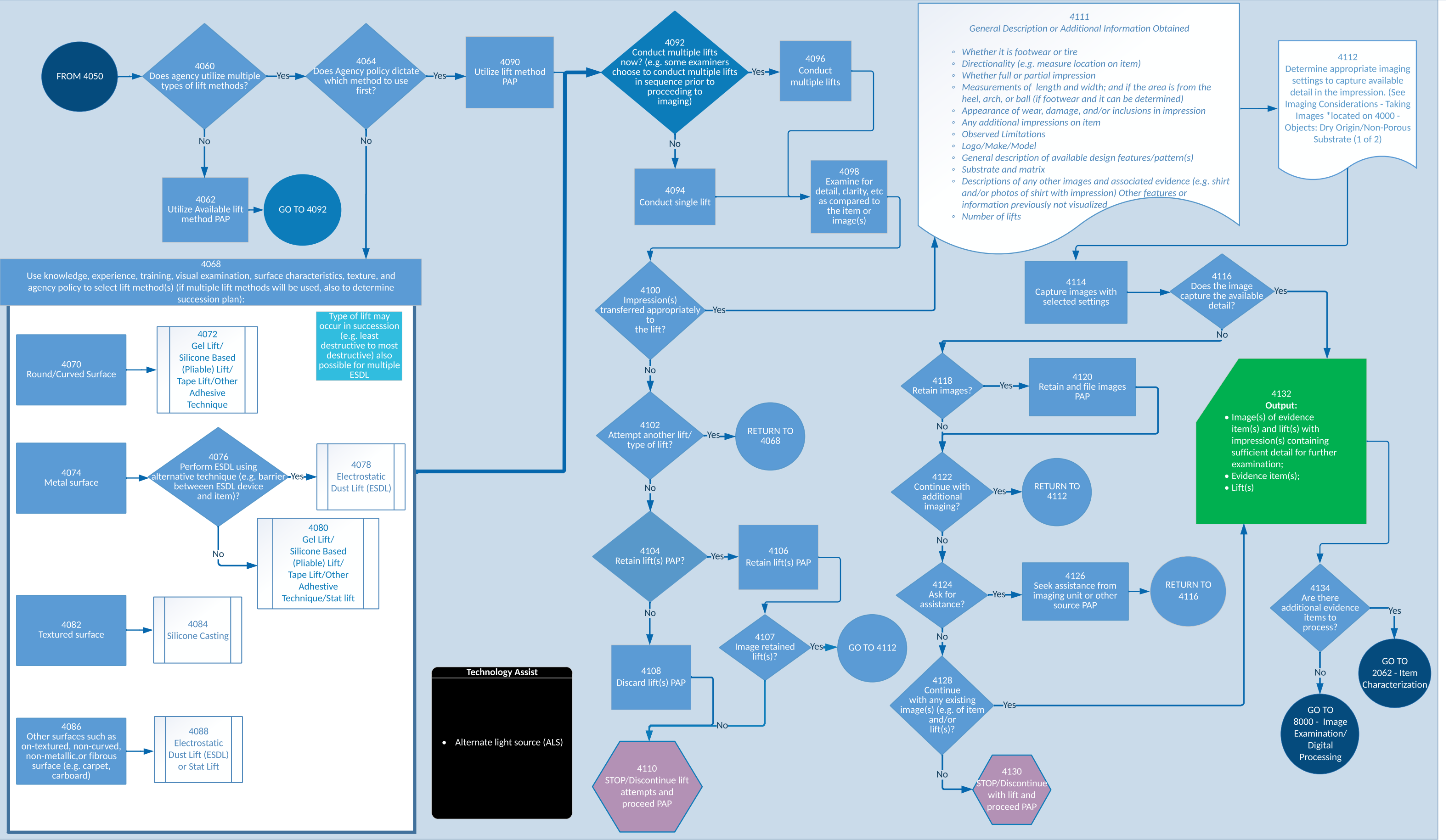


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4000 - Object: Dry Origin/Non-Porous Substrate (1 of 2)

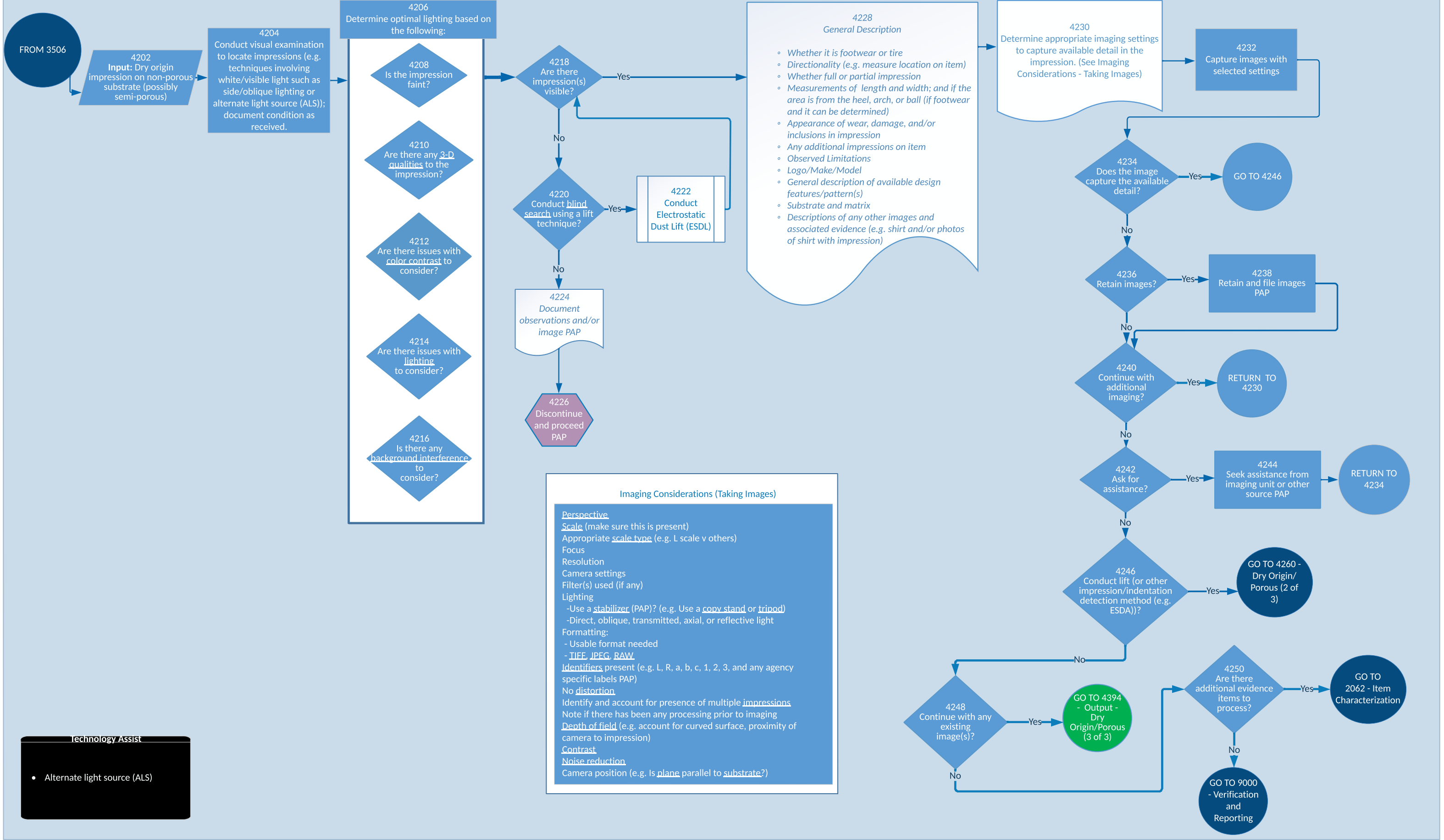


4000 - Object: Dry Origin/Non-Porous Substrate (2 of 2)



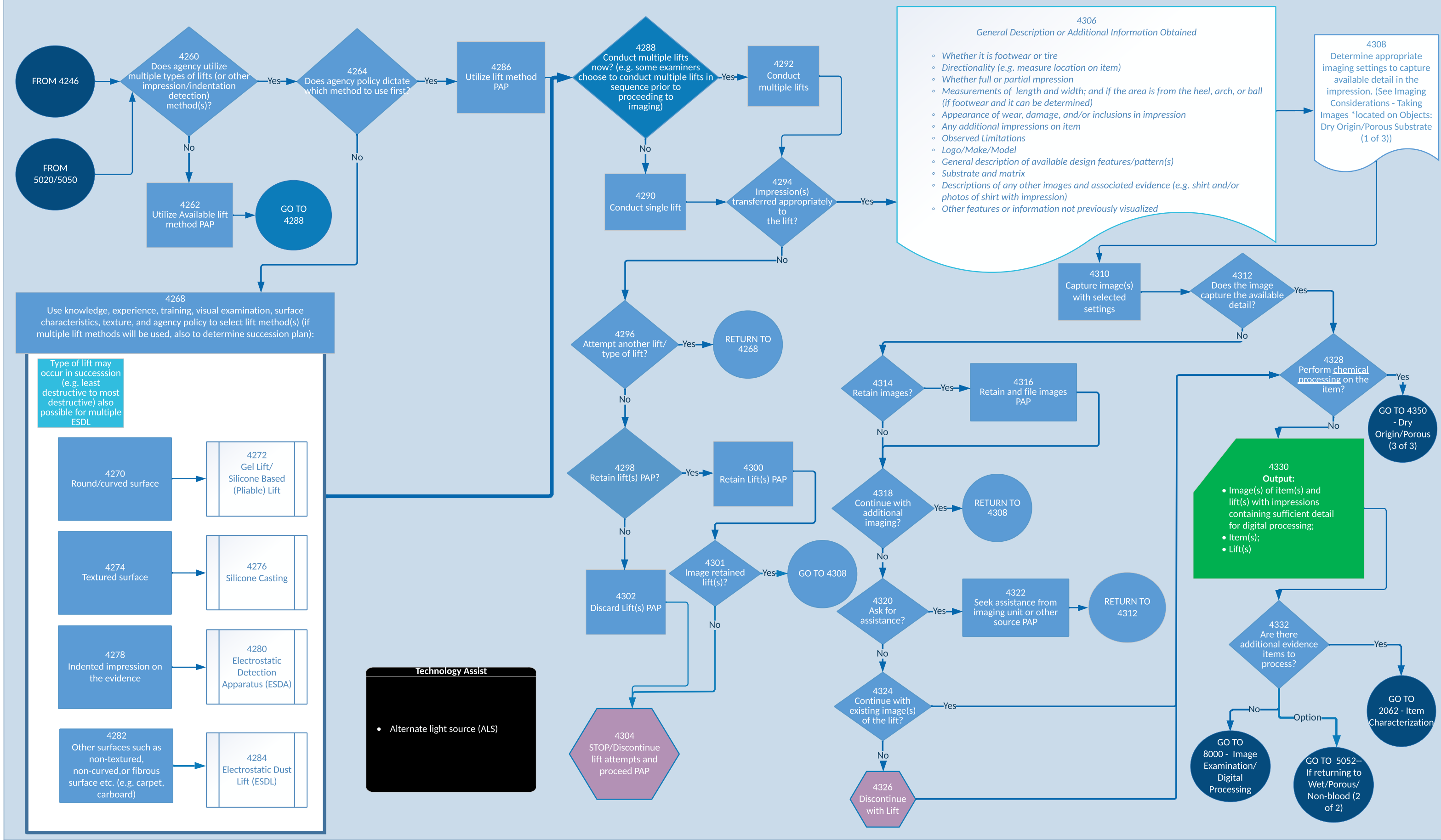
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4200 - Object: Dry Origin/Porous Substrate (1 of 3)



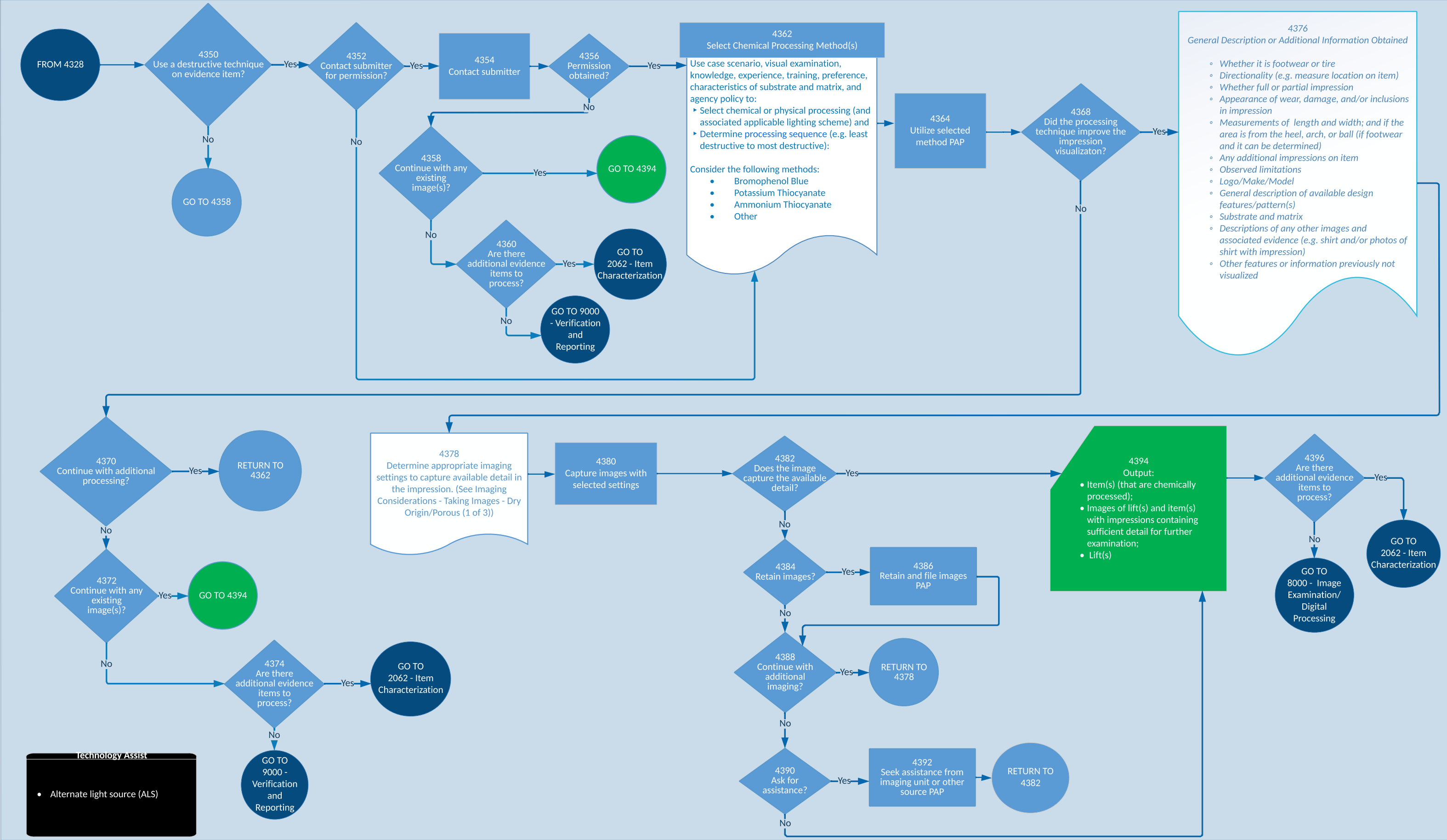
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4200/4300 - Object: Dry Origin/Porous Substrate (2 of 3)



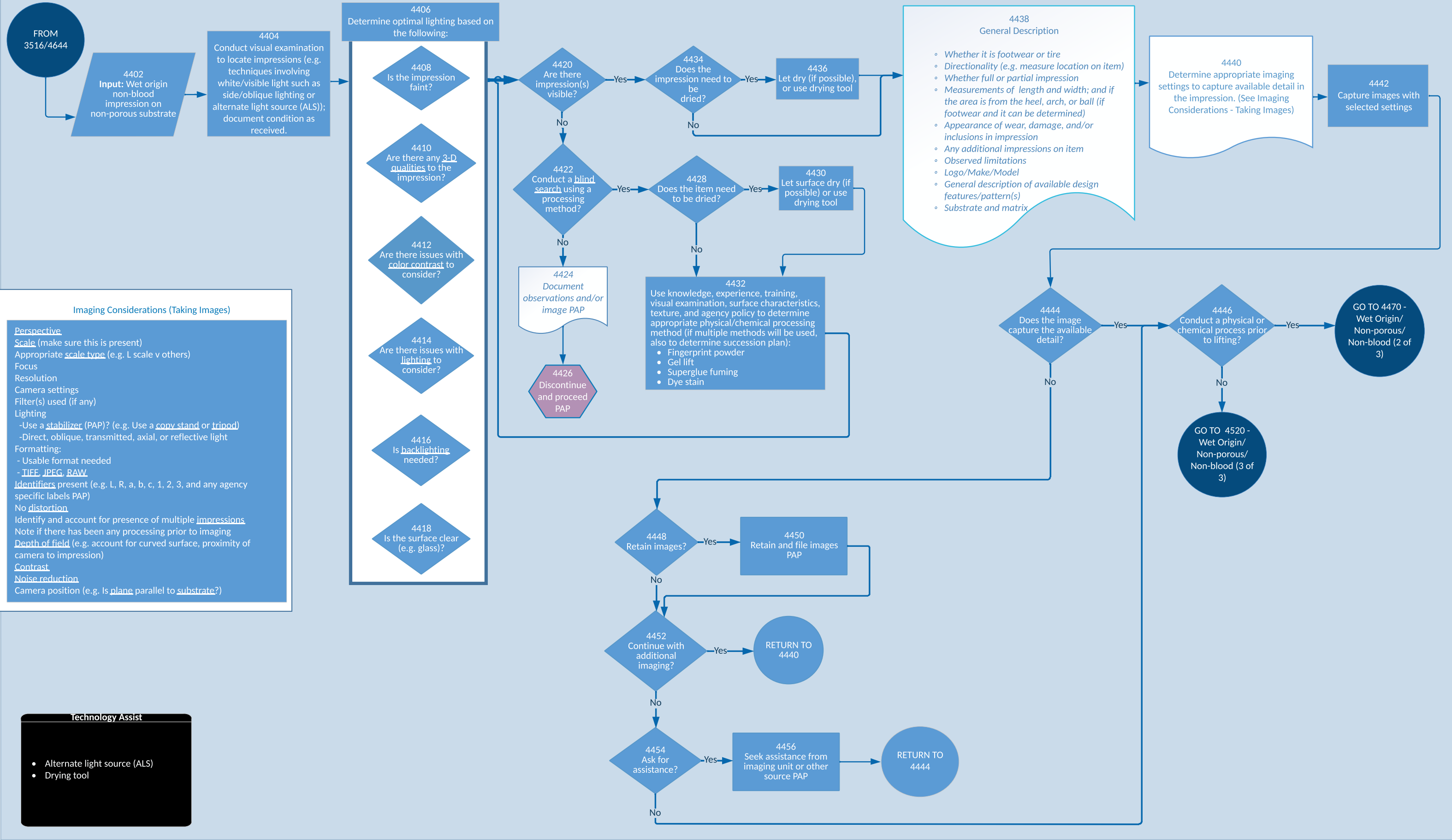
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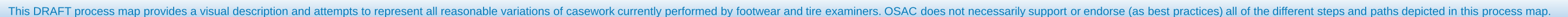
4300 - Object: Dry Origin/Porous Substrate (3 of 3)



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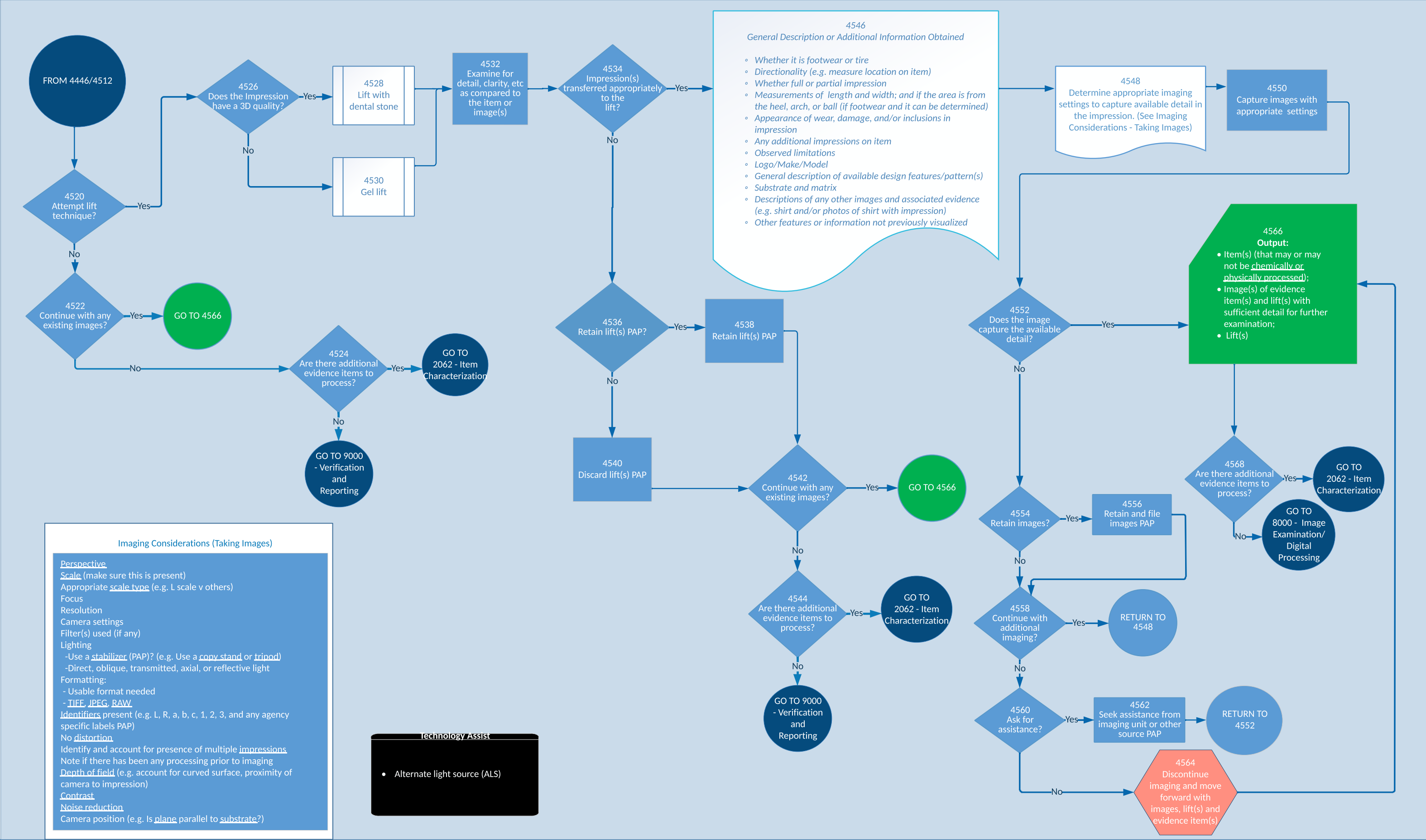
4400 - Object: Wet Origin/Non-Porous Substrate/Non-Blood (1 of 3)





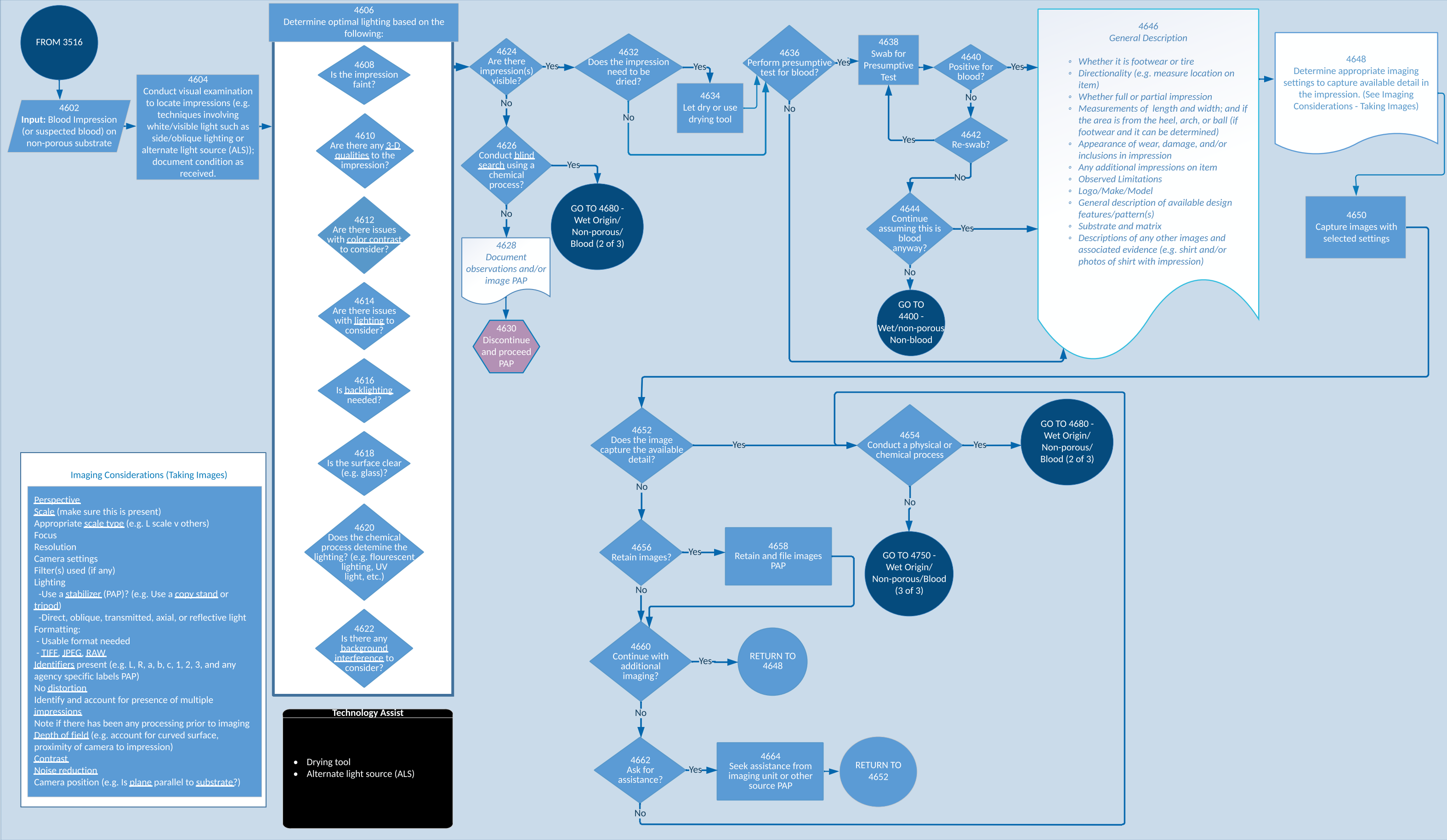
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4500 - Object: Wet Origin/Non-Porous Substrate/Non-Blood (3 of 3)



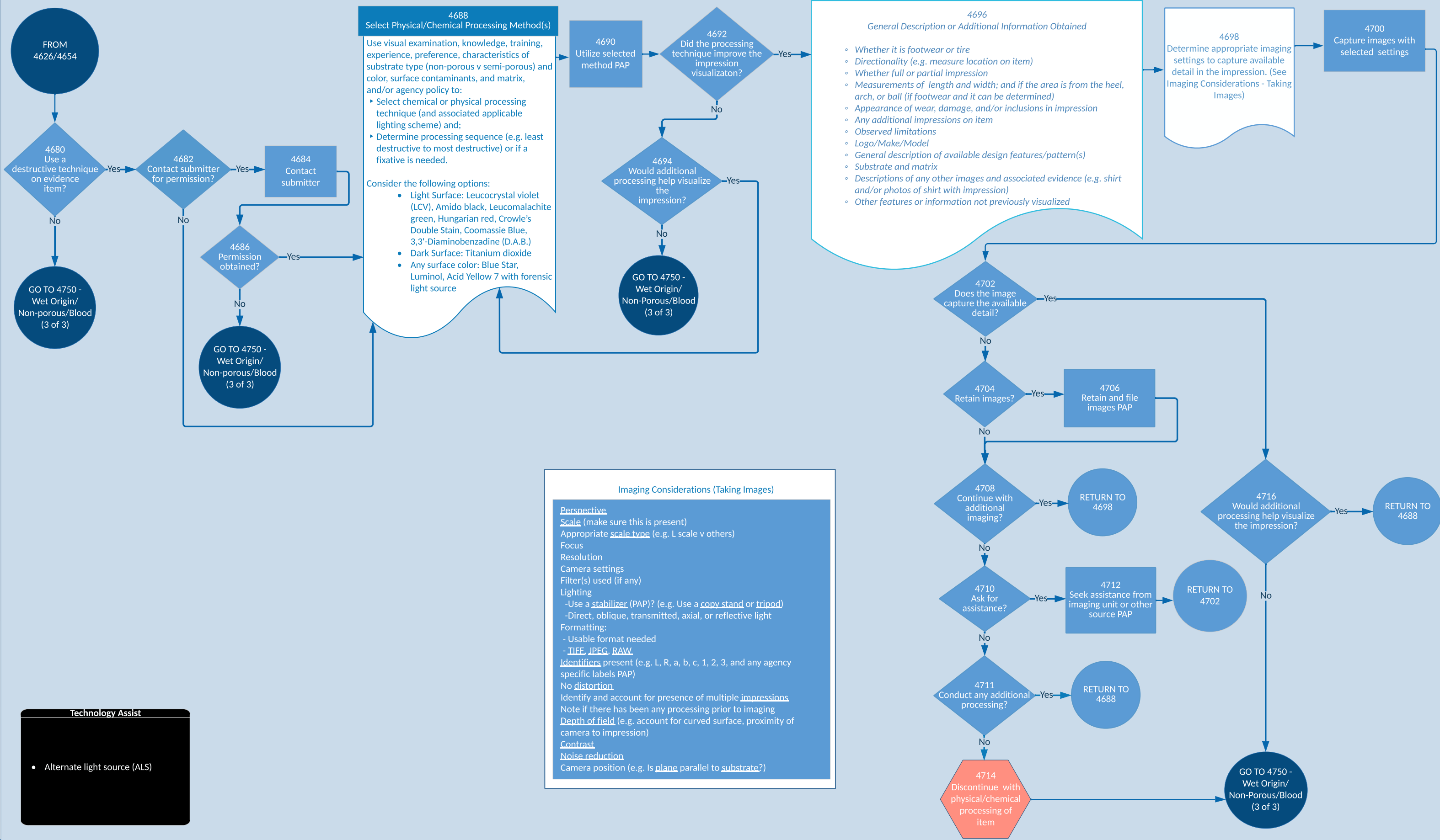
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4600 - Wet Origin/Non-Porous Substrate/Blood (1 of 3)



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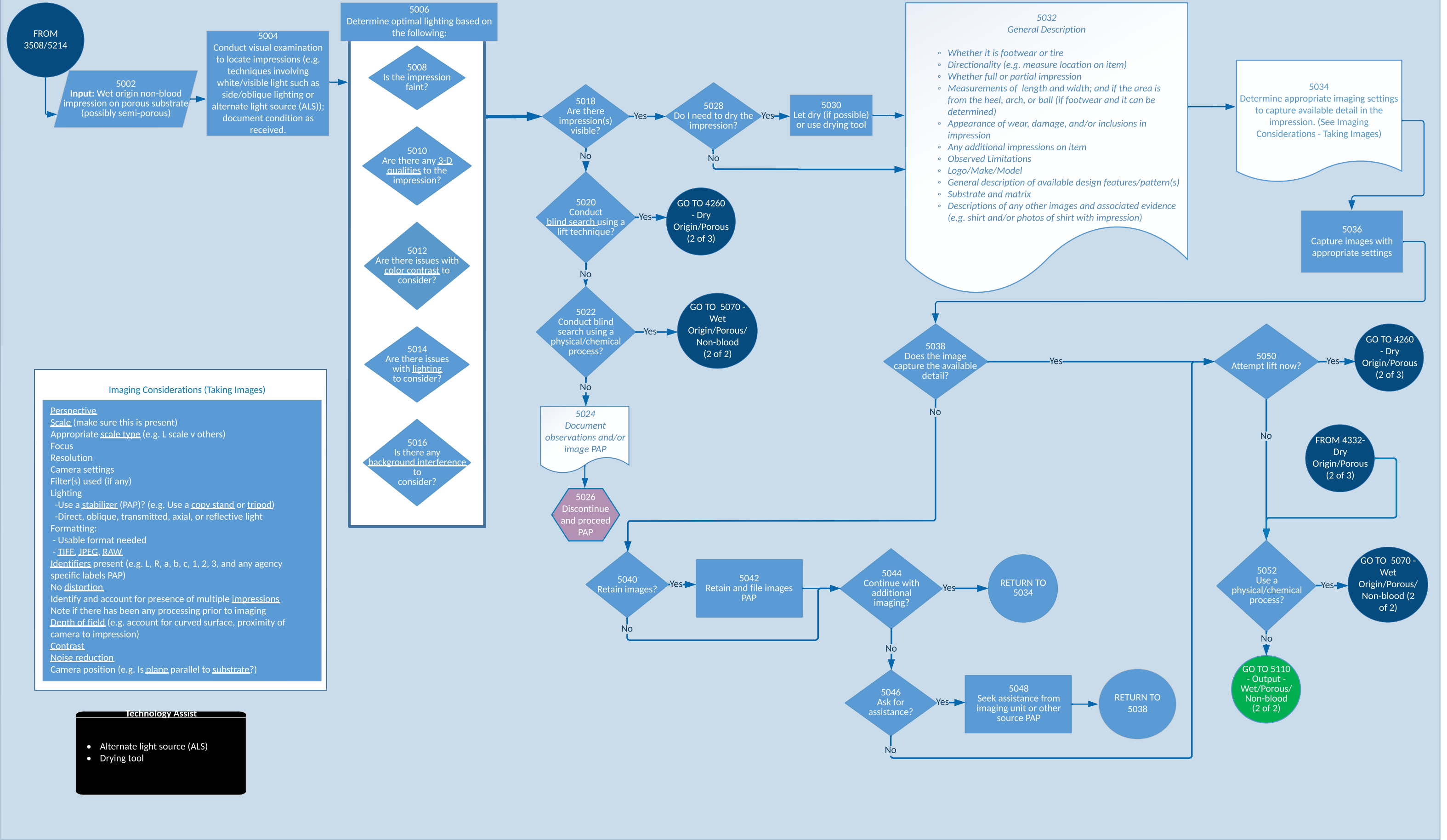
4600/4700 - Wet Origin/Non-Porous Substrate/Blood (2 of 3)





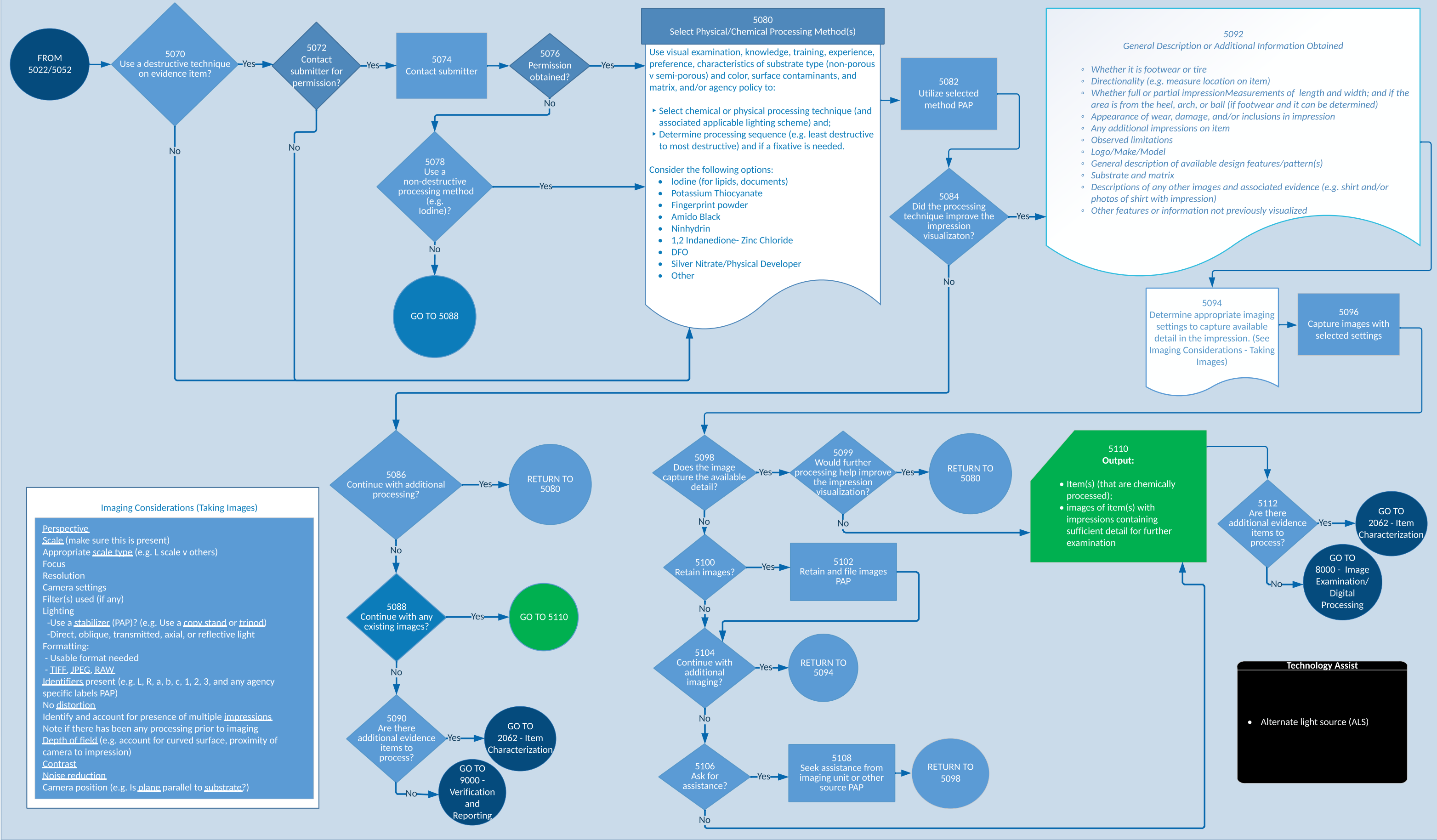
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5000 - Object: Wet Origin/Porous Substrate/Non-Blood (1 of 2)



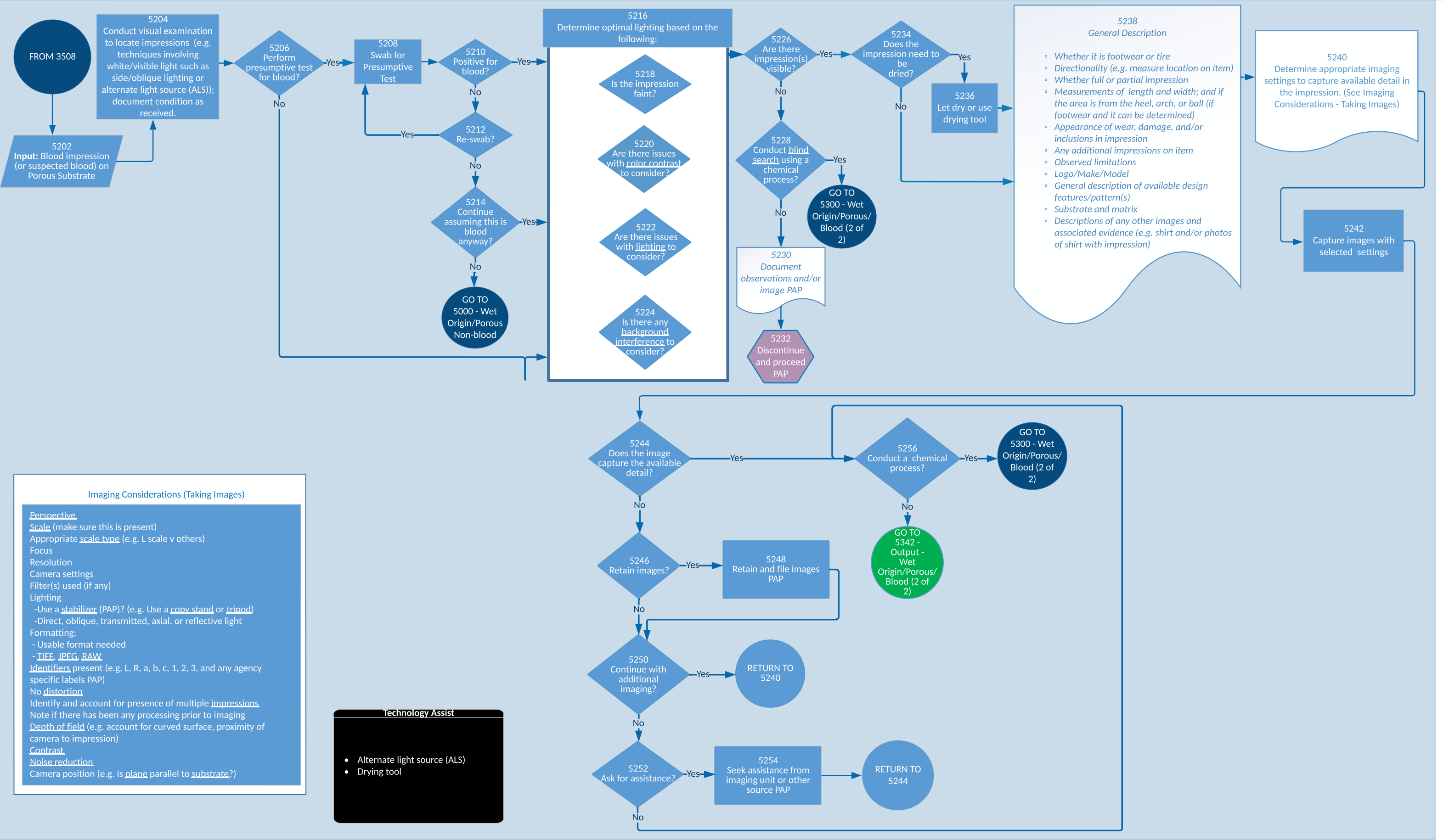
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5000 - Object: Wet Origin/Porous Substrate/Non-Blood (2 of 2)



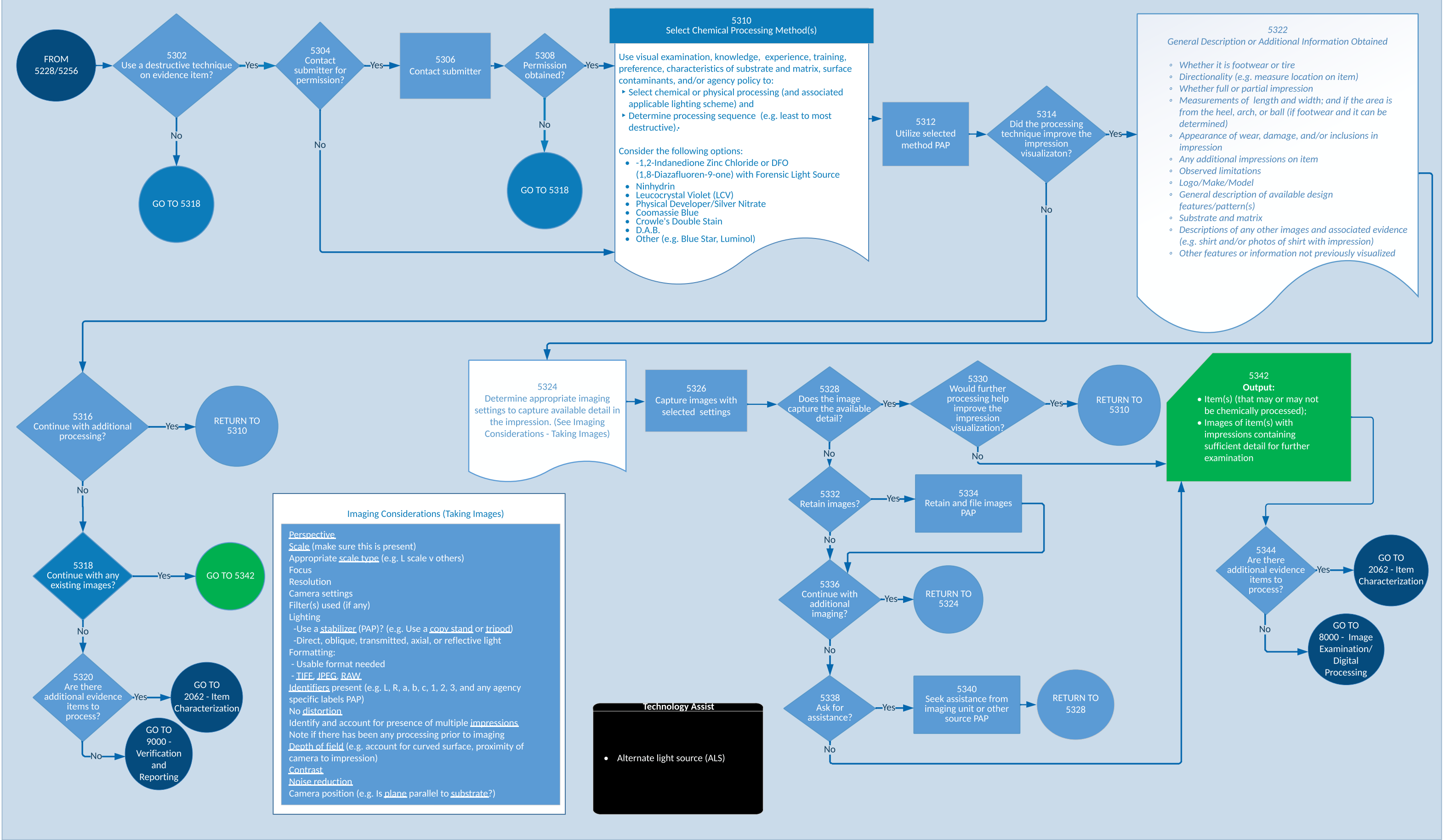
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5200 - Object: Wet Origin/Porous Substrate/Blood (1 of 2)



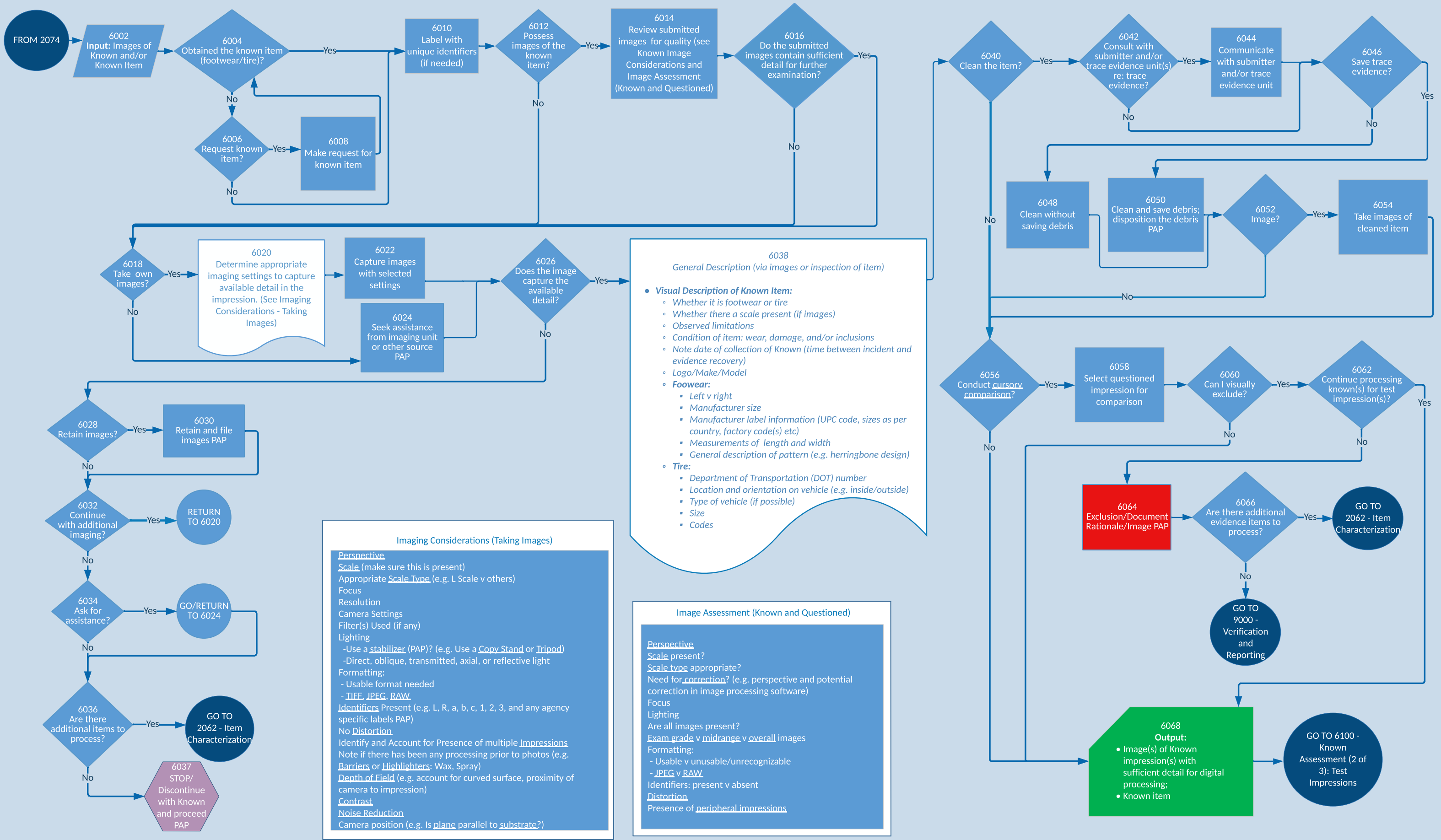
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5300 - Object: Wet Origin/Porous Substrate/Blood (2 of 2)



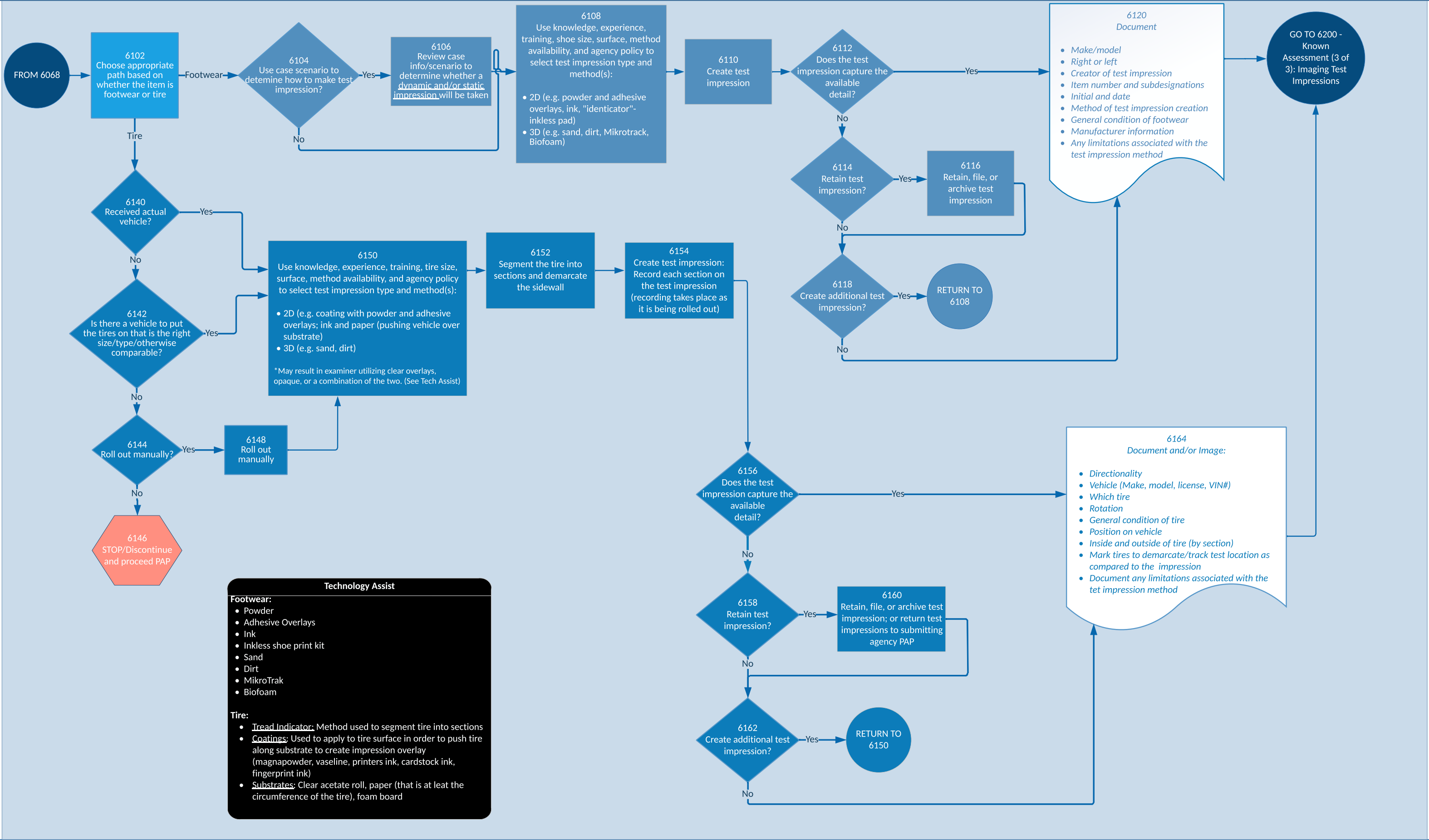
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6000 - Known Assessment (1 of 3): Image/Item Assessment



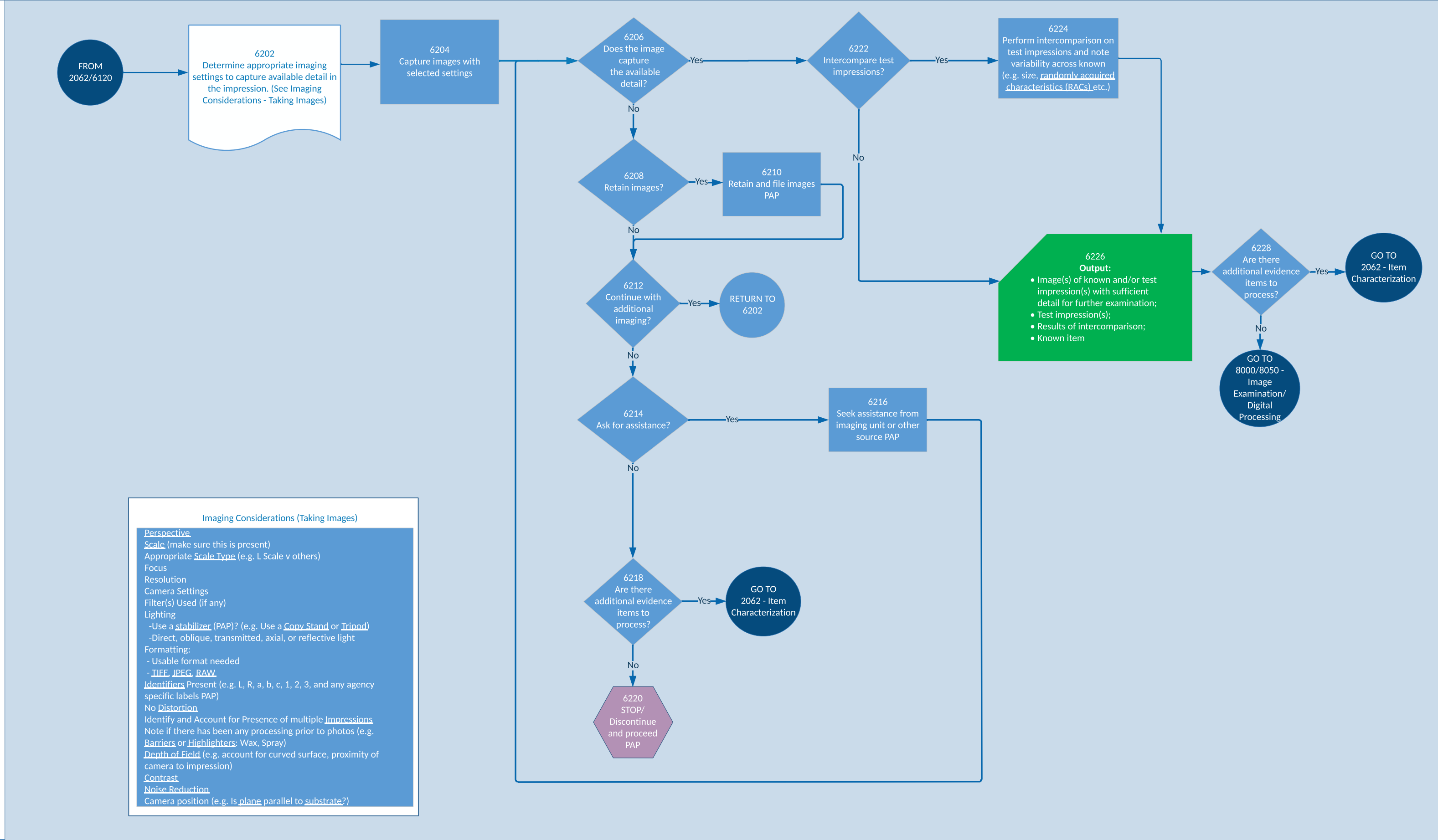
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6100 - Known Assessment (2 of 3): Test Impressions



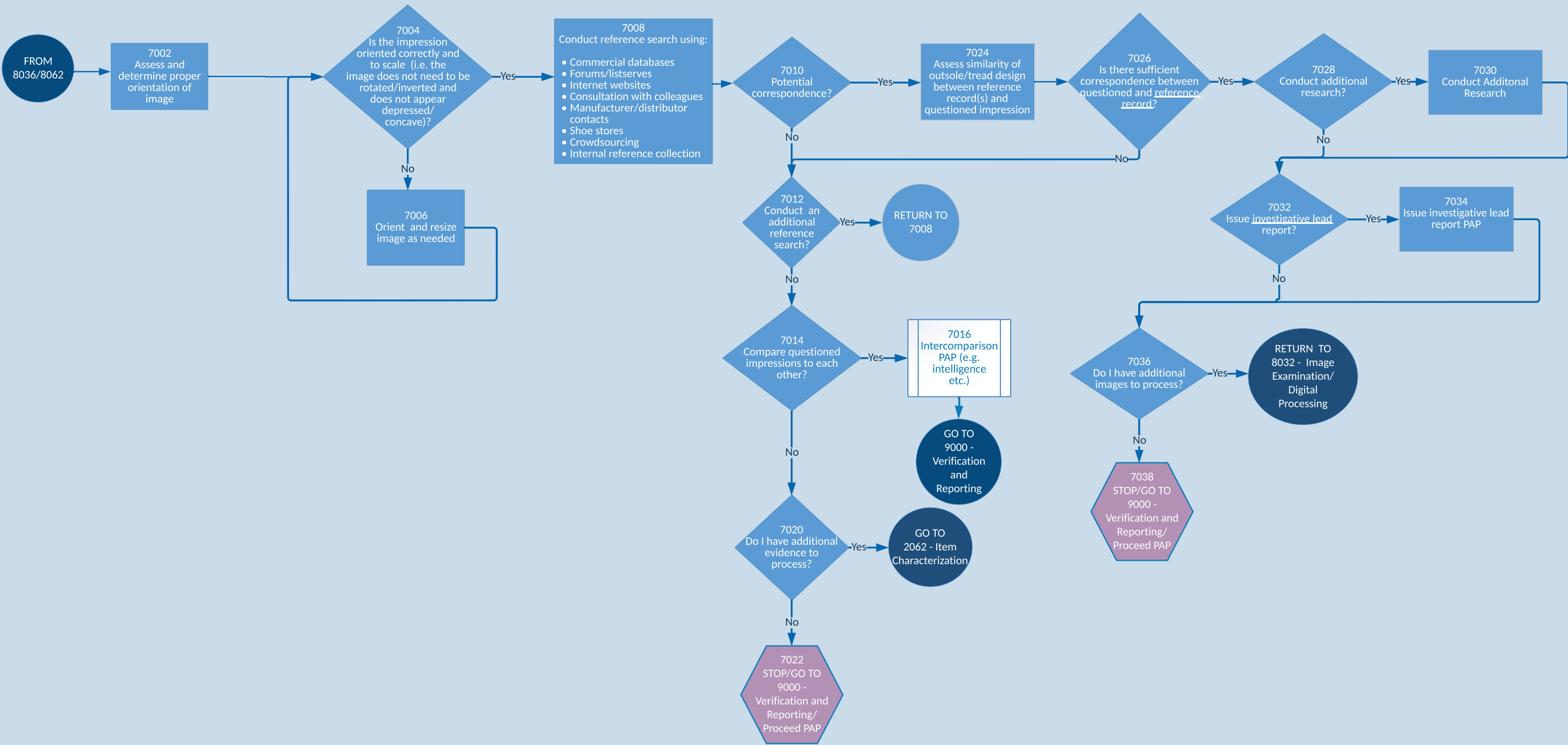
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6200 - Known Assessment (3 of 3): Imaging Test Impressions



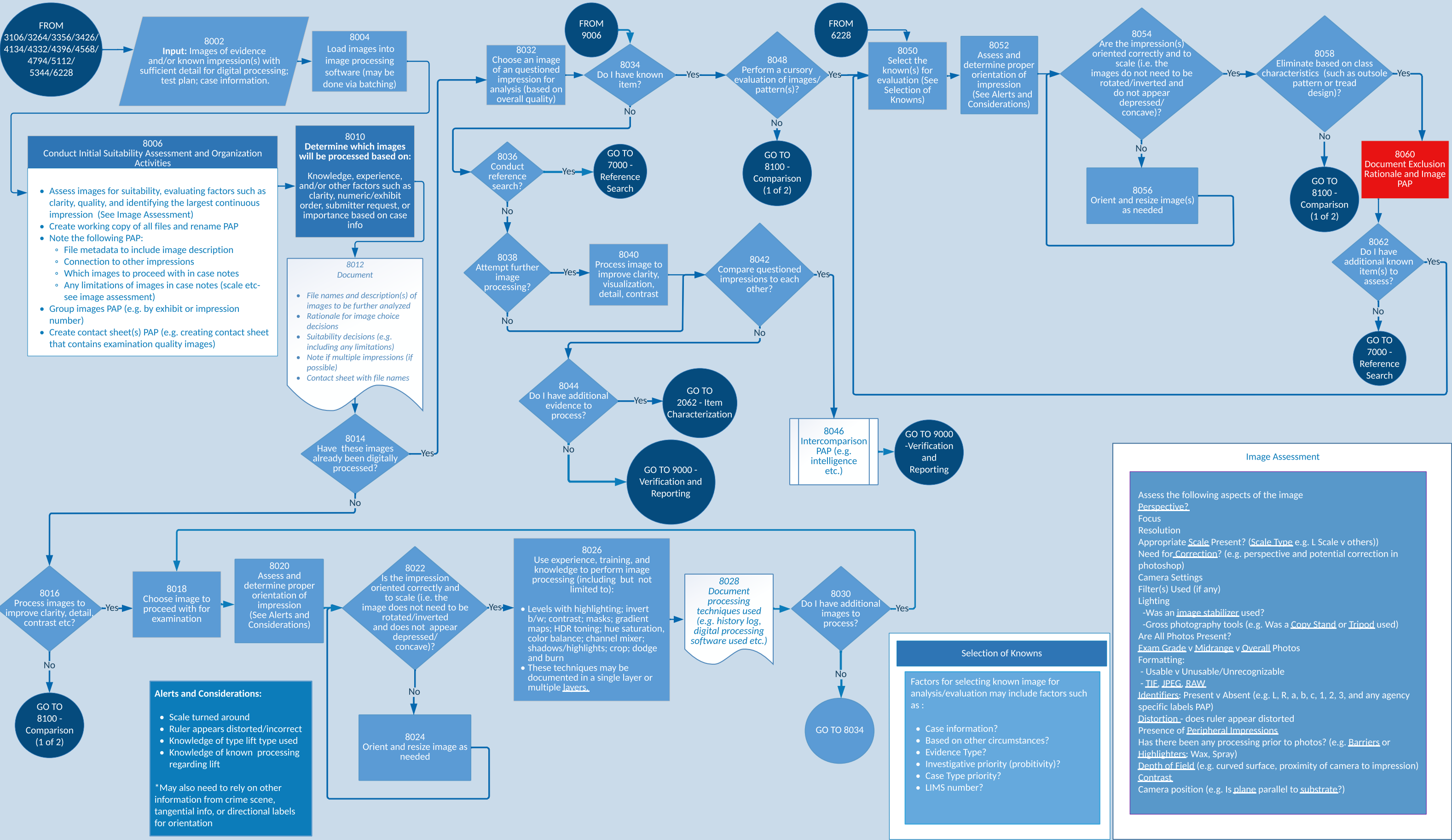
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7000 - Reference Search



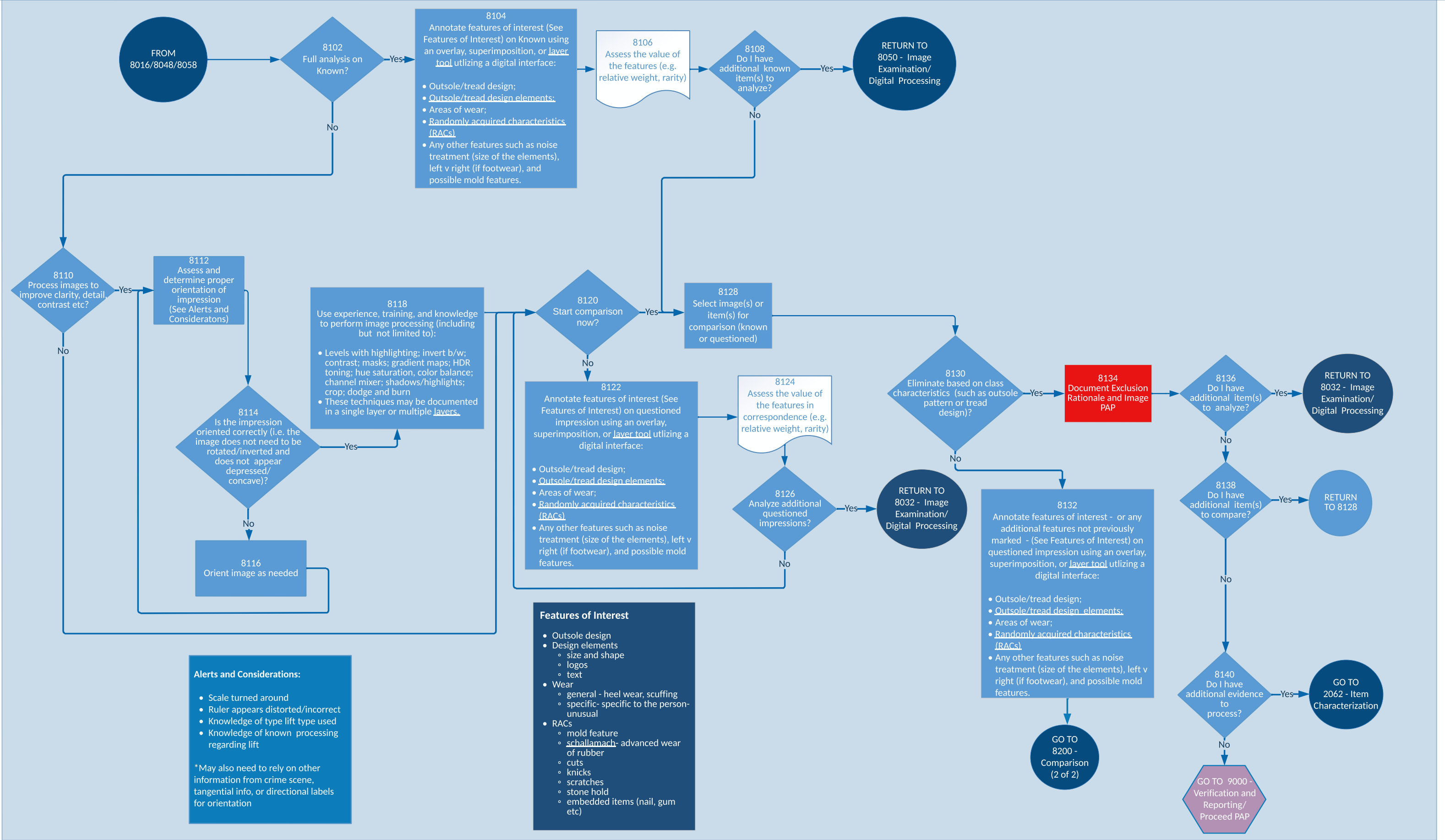
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8000 - Image Examination and Digital Processing



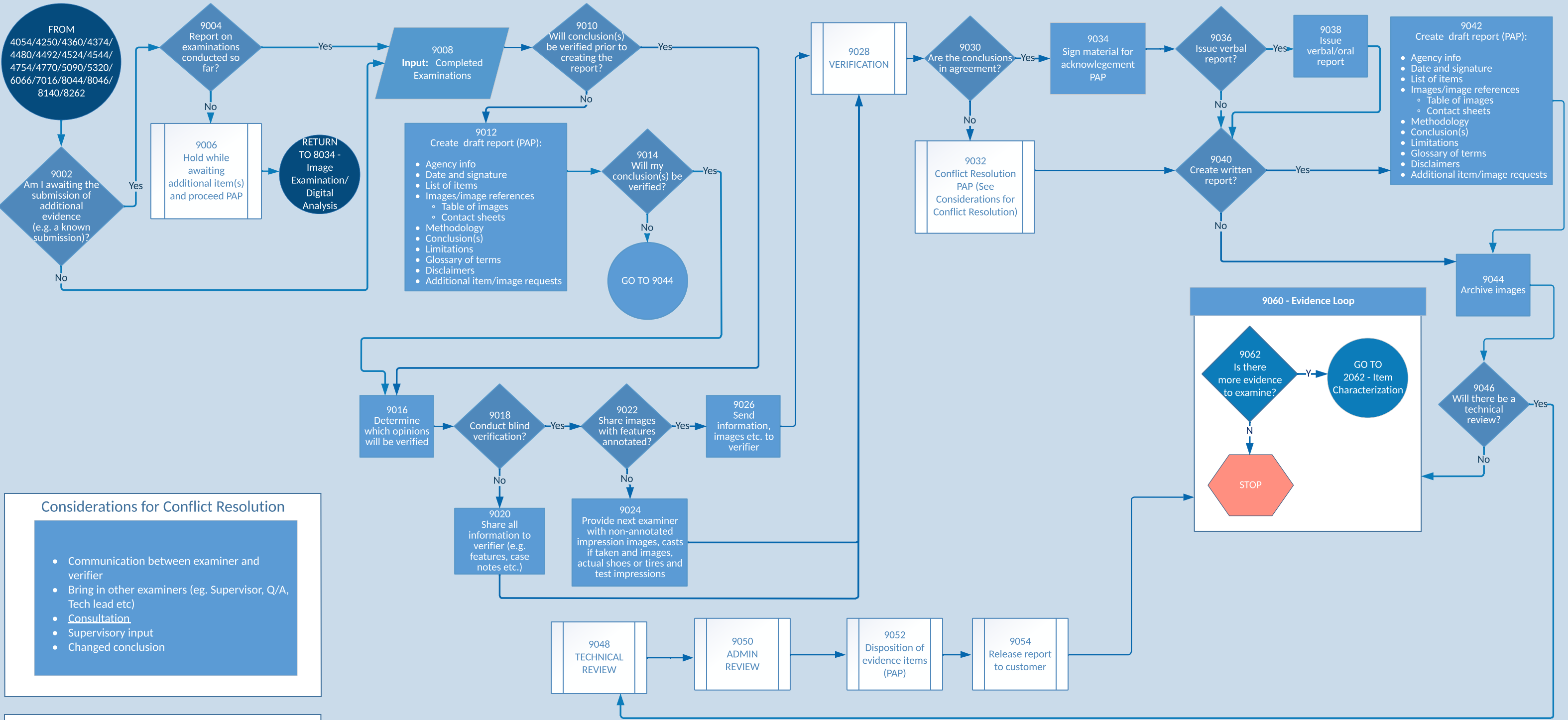
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8100 - Comparison (1 of 2)



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9000 - Verification and Reporting



Considerations for Conflict Resolution

- Communication between examiner and verifier
- Bring in other examiners (eg. Supervisor, Q/A, Tech lead etc)
- Consultation
- Supervisory input
- Changed conclusion

Considerations for Verification

- Does Examiner provide all examination documentation (e.g. layers, markups etc.) to Verifying examiner?
- Does Examiner provide conclusion of comparison to Verifying examiner?
- Will case be completely reworked by another examiner or via additional/different methods?

Glossary of Terms and Definitions

3-D qualities– Three-dimensional characteristics of a footwear or tire track impression.

Background interference– Aberrations in the substrate which the footwear or tire track impressions is present which can cause light or focusing distortions during impression visualization or photography.

Backlighting– Application of light behind a footwear or tire track impression specifically on glass so that the light passes through the impression and into the aperture of the camera.

Barriers– Spray used specifically on footwear or tire track impressions made in soft substrates which hardens on the surface of the impression so that subsequent casting will not damage impression.

Blind search– Conduction a search for footwear or tire-track impressions which are not readily visible to a naked eye by using lighting and or lifting techniques.

Chain of Custody (CoC)– Chronological record of the handling and storage of an item from its point of collection to its final return or disposal.

Chemically or physically processed– Addition of a variety of chemicals or reagents to improve visualization of footwear and tire track impression.

Color contrast– The difference in luminance or color that makes an object distinguishable from other objects within the same field of view.

(Trial) Continuance– The suspension or postponement of a trial or court proceeding.

Contrast– How well black can be distinguished from white at a given resolution.

Copy stand– The stand consists of a platform onto which the item is placed where the camera can be mounted above and parallel to it, usually with an adjustable height. This may or may not include lighting.

Correction– Attempts in image analysis tools to correct or remedy image distortion artifacts.

Depth of Field– The distance that is in focus (sharp) when capturing an image based upon the camera and lens, and their settings.

Distortion– An unclear or inaccurate representation of the footwear or tire in an impression due to interference in the impression-making process or its subsequent retrieval.

Electrostatic Dust Lift– An instrument that utilizes an electrostatic charge as a means of transferring dry origin impressions from a substrate to a film.

Exam grade(photos)– A photograph taken following a specific protocol for the purpose of conducting a forensic comparative examination.

Gel Lift– Gelatin applied to a pliable backing that can be used to lift impressions

Highlighters– Sprays, paints or waxes used to increase contrast of footwear and tire track impressions particularly in snow.

Identifiers– Details use to establish or recognize the identity of; ascertain as a certain item of evidence.

Impressions– The product of direct physical contact of an item, such as a footwear or tire, resulting in the transfer and retention of characteristics of that item.

Investigative lead– Updated information regarding a case which can assist in the investigation.

JPEG– Image compression and storage format specified by the Joint Photographic Experts Group. It is discrete cosine transform-based.

Laboratory Information Management System (LIMS)– Is a type of software designed to improve lab productivity and efficiency, by keeping track of data associated with samples, experiments, laboratory workflows, and instruments.

Layers– One image is stacked on top of another image and can annotated so that the base image is not affected.

Layer tool– Tool used in image processing software such as Photoshop to apply a layer to an image.

Lighting– Application of light to an item of evidence to observe visually of record photographically.

Limitation– A shortcoming or defect.

Memorandum for record (MFR)– Memo covering information that would otherwise not be recorded in writing.

Glossary of Terms and Definitions

Midrange (photos)– Establishes the location of evidence and what relationship that evidence has to the scene

Natural size– Life-size reproduction. * An image magnification of 1X i.e. the image is the same size as the object.

Noise reduction–*Noise treatment*- The mixed arrangement of tread blocks sizes used by the tire industry to reduce noise generated by tires.

Outsole/tread design elements– A general category of footwear outsole patterns (i.e. herringbone pattern, lugged outsole pattern, wave pattern, plain soles, etc.).

Overall (photos)– Photographs which capture the global aspects of the crime scene to show exactly where the scene was and to show all boundaries of the scene.

Peripheral impressions– Footwear or tire track impression which appear next to the impressions in question.

Perspective– In image analysis, camera-to-subject geometry, including both camera-to-subject distance and orientation of the camera relative to the subject.

Plane– An imaginary line, flat area or field which lies perpendicular to the optical axis. The “Optical Axis” passes through the centre of the lens and the image sensor.

Quality– An inherent or distinguishing characteristic; a property.

Quantity– Physical properties subject to measurement, such as length, time, weight, and concentration.

Randomly Acquired Characteristics (RACs)– A feature on a footwear outsole or tire tread resulting from random events including, but not limited to: cuts, scratches, tears, holes, stone holds, abrasions and the acquisition of debris. The position, orientation, size and shape of these characteristics contribute to the uniqueness of a footwear outsole or tire tread. Randomly acquired characteristics are essential for an identification of a particular item of footwear or tire as the source of an impression.

RAW– A family of file formats, often specific to different models of digital imagery equipment, that are not yet processed for storage in a 'printable' image format such as JPEG or TIFF. The file extension '.raw' is only one such format.

Reference record– Known footwear or tire track impressions record and stored in a reference library or database.

Scale/Scale type–A ruler marked with a range of calibrated scales (ratios) for drawing and measuring

Schallamach– Microscopic patterns that develop as ridges on rubber material as a result of repeated abrasive forces. These patterns are very similar in their size and appearance to skin friction ridges and are highly individual. They continue to change rapidly as affected by continued abrasion. Schallamach patterns are randomly acquired characteristics. The term gets its name from a researcher of the same name.

Sidewall –The side of an automotive tire between the tread shoulder and the rim bead which contains information specific to the make, model and manufacturing specific to that tire.

Stabilizer– Devices used to remove movement during image capture which include copy stands and tripods.

Subdesignations– Application of unique identifiers to items of evidence.

Substrate– Surface upon which a footwear or tire track impression is deposited.

TIFF– Tagged Image File Format

Tripod–A three-legged stand for supporting a camera or other apparatus.